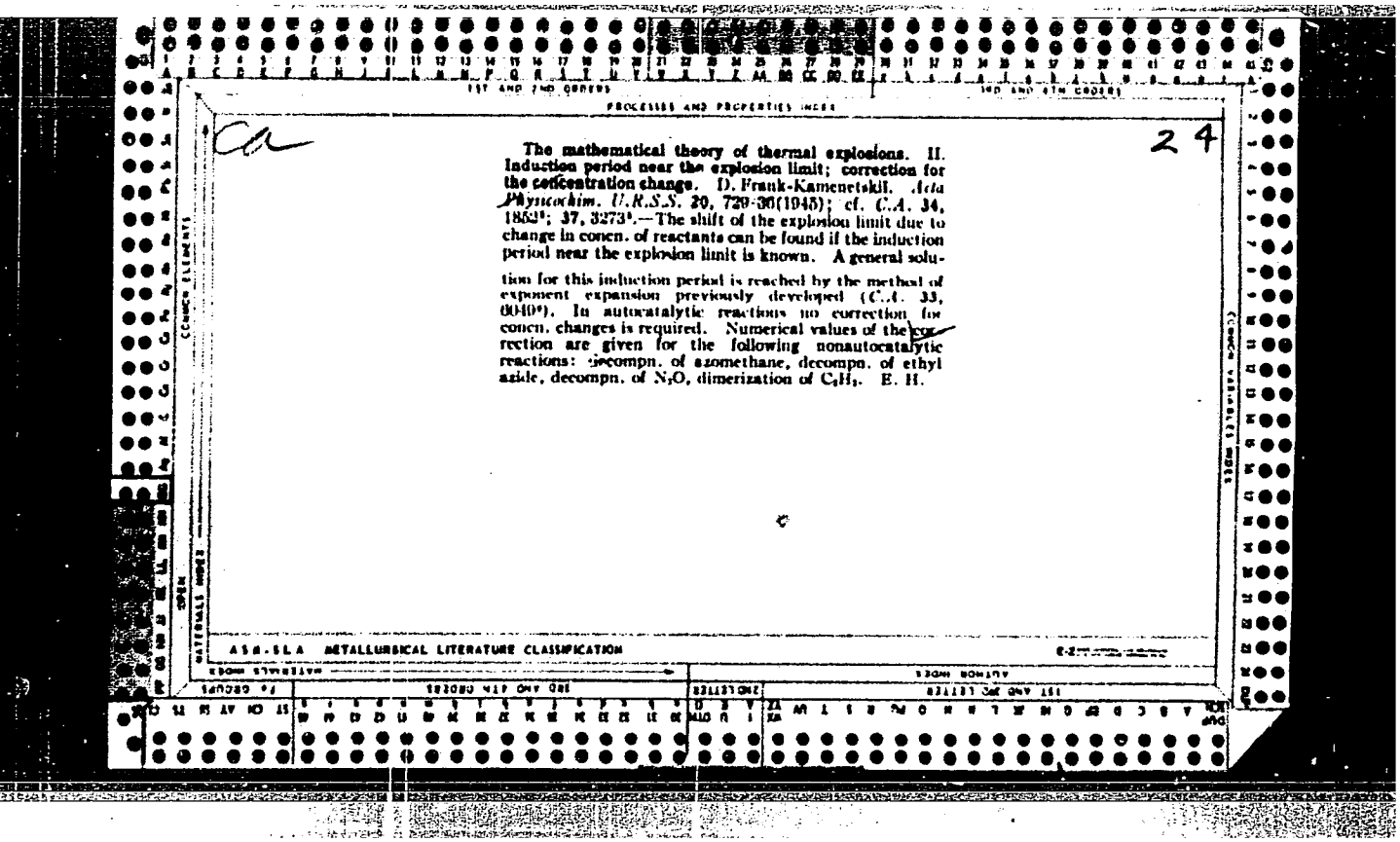
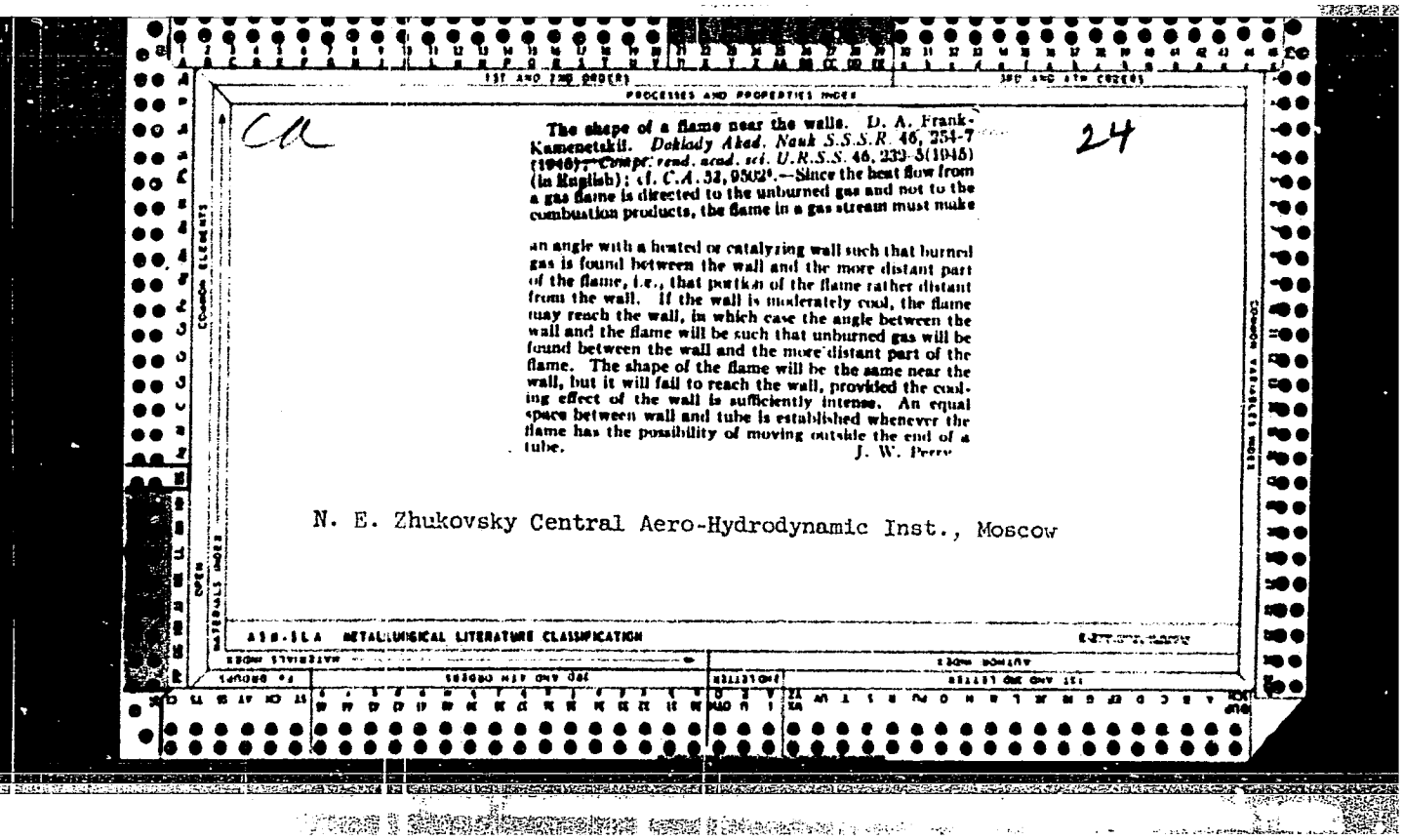


PROCESSES AND PROPERTIES INDEX

24

The mathematical theory of thermal explosions. II. Induction period near the explosion limit; correction for the concentration change. D. Frank-Kamenetskii. *Acta Physicochim. U.R.S.S.* **20**, 729-36(1945); cf. *C.A.* **34**, 1855[9]; **37**, 3273[8].—The shift of the explosion limit due to change in concn. of reactants can be found if the induction period near the explosion limit is known. A general solution for this induction period is reached by the method of exponent expansion previously developed (*C.A.* **33**, 8040[9]). In autocatalytic reactions no correction for concn. changes is required. Numerical values of the correction are given for the following nonautocatalytic reactions: decompn. of azomethane, decompn. of ethyl azide, decompn. of N_2O, dimerization of C_4H_5. E. H.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



PROCESSES AND PROPERTIES INDEX

CL

24

The shape of a flame near the walls. D. A. Frank-Kamenetskii. *Doklady Akad. Nauk S.S.S.R.* 46, 254-7 (1945); *Compt. rend. acad. sci. U.R.S.S.* 46, 239-5(1945) (in English); cf. *C.A.* 52, 9502i.—Since the heat flow from a gas flame is directed to the unburned gas and not to the combustion products, the flame in a gas stream must make an angle with a heated or catalyzing wall such that burned gas is found between the wall and the more distant part of the flame, i.e., that portion of the flame rather distant from the wall. If the wall is moderately cool, the flame may reach the wall, in which case the angle between the wall and the flame will be such that unburned gas will be found between the wall and the more distant part of the flame. The shape of the flame will be the same near the wall, but it will fail to reach the wall, provided the cooling effect of the wall is sufficiently intense. An equal space between wall and tube is established whenever the flame has the possibility of moving outside the end of a tube.
J. W. Perry

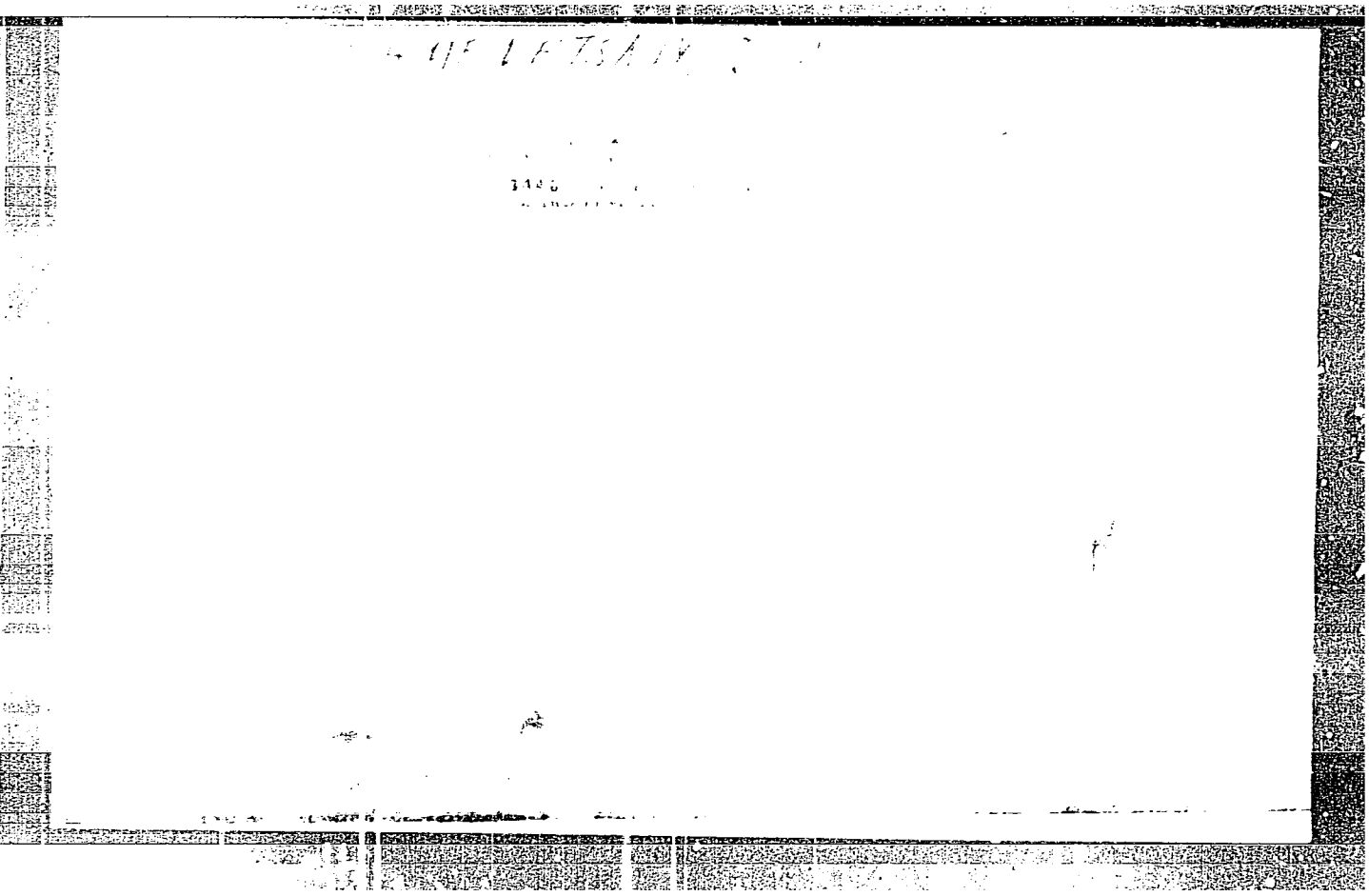
N. E. Zhukovsky Central Aero-Hydrodynamic Inst., Moscow

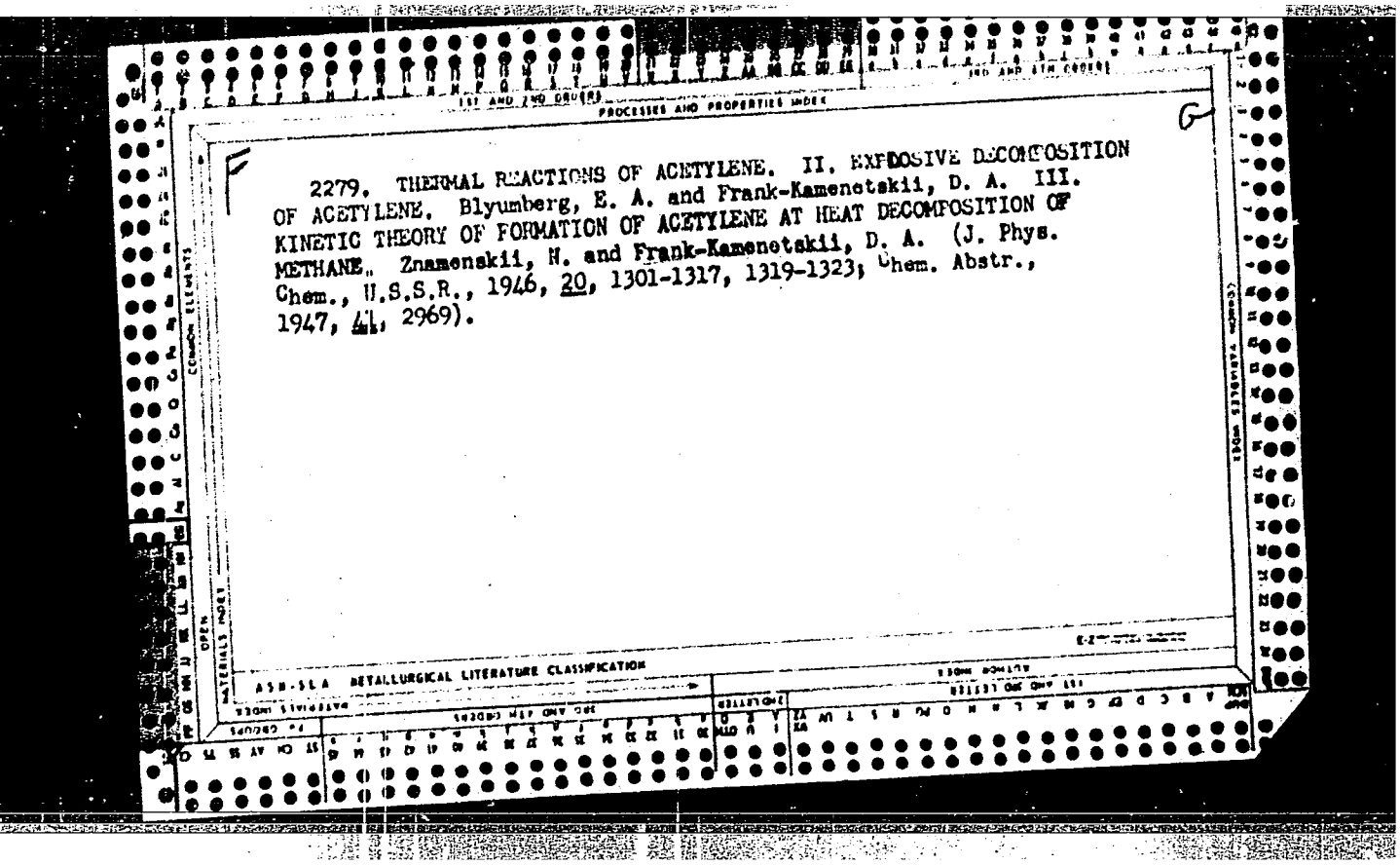
A 1 8 - 1 L A METALLURGICAL LITERATURE CLASSIFICATION

CA

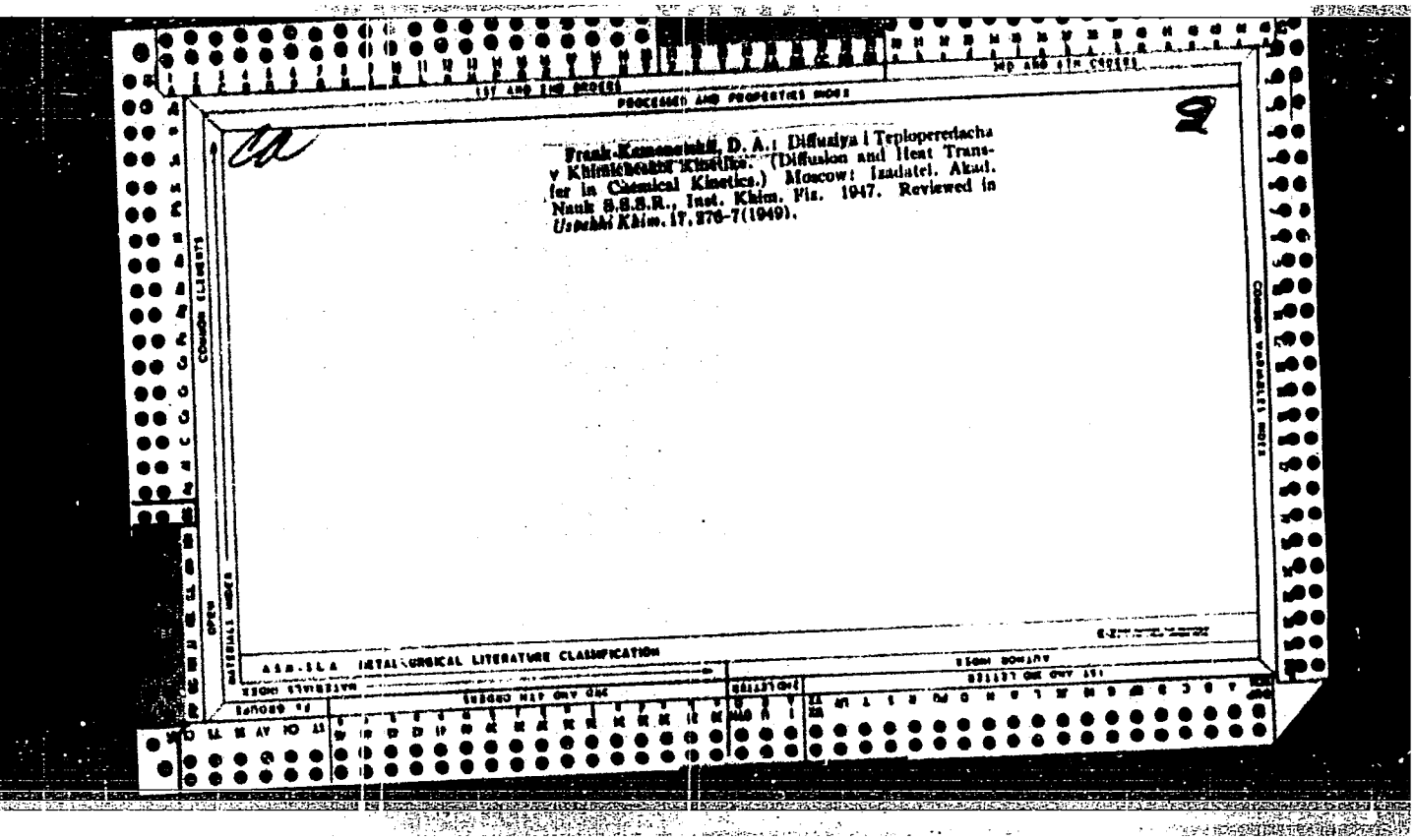
21

Microdiffusional turbulent combustion. D. A. Frank-Kamenetskii and E. M. Minskii. *Doklady Akad. Nauk S.S.S.R.* 50, 383-4(1945).—When the microturbulence in the stream of air (produced by baffles) is less than the degree of atomization (comminution) of the particles of liquid fuel (gasoline), micromixing occurs after turbulent-diffusion, and the rate of burning increases proportionally with the velocity of the stream. O. W. Willcox





2279. THERMAL REACTIONS OF ACETYLENE. II. EXPLOSIVE DECOMPOSITION OF ACETYLENE. Blyumberg, E. A. and Frank-Kamenetskii, D. A. III. KINETIC THEORY OF FORMATION OF ACETYLENE AT HEAT DECOMPOSITION OF METHANE. Znamenskii, N. and Frank-Kamenetskii, D. A. (J. Phys. Chem., U.S.S.R., 1946, 20, 1301-1317, 1319-1323; Chem. Abstr., 1947, 41, 2969).



Frank-Kamenetskii, D. A.: Diffuziya i Teploperedacha v Khimicheskoi Kinetike. (Diffusion and Heat Transfer in Chemical Kinetics.) Moscow: Izadatel. Akad. Nauk S.S.S.R., Inst. Khim. Fiz. 1947. Reviewed in *Uspekhi Khim.* 17, 376-7(1949).

C2.h
C1.h
E3.h

FRANK-KAMENETSKIY, D. A.

Dr. of chem. sciences (Institut Khimicheskoy fiziki AN SSSR).

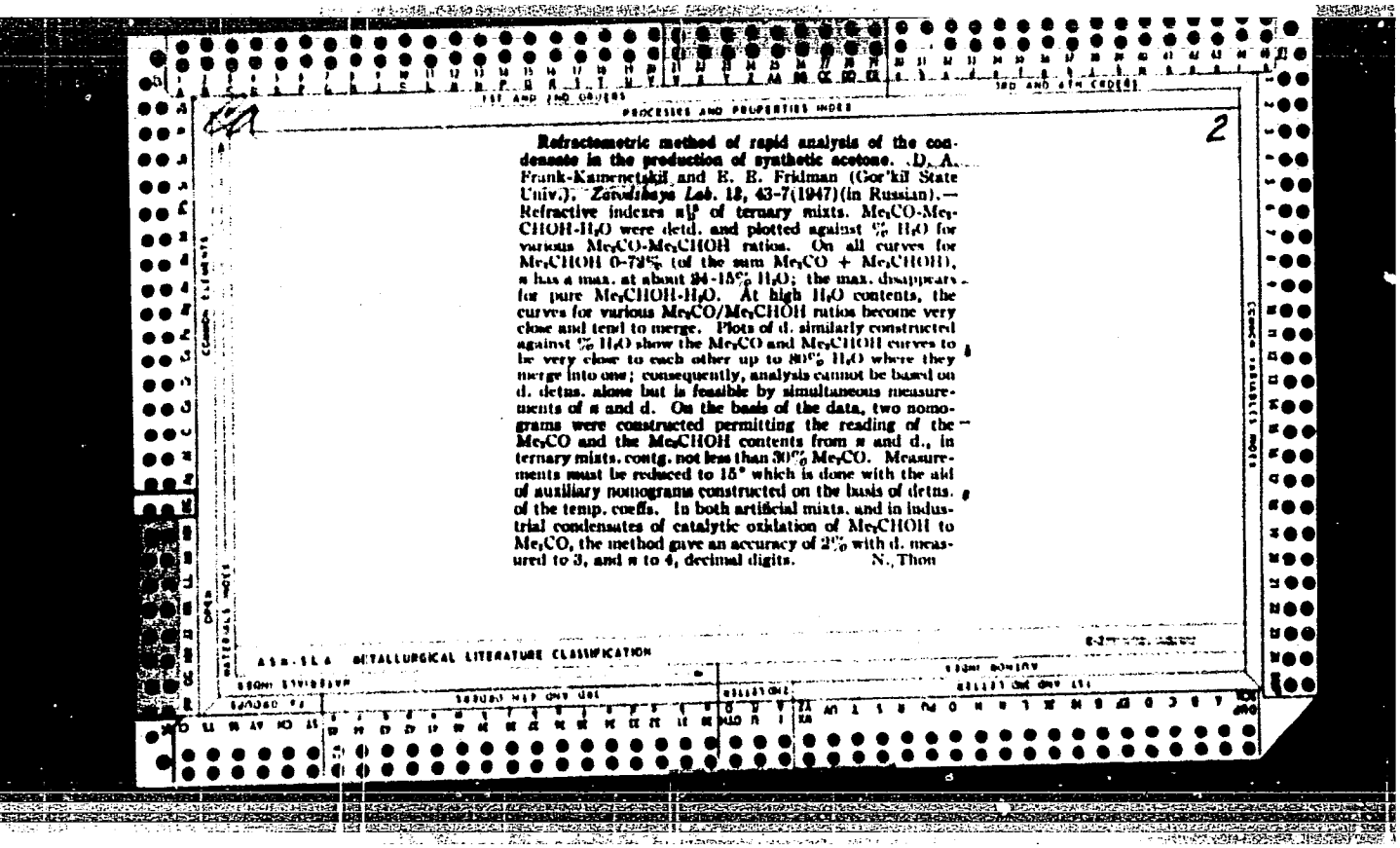
Delivered a paper "Modelirovaniye protsessov perenosa" at Vsesoyuznoye konferentsiya po katalizu. May 1947. Moscow.

Source: Uspekhi khimii, 1947, No. 4, p. 595.

P-4072

ZEL'DOVICH, Ya.B.; SADOVNIKOV, P.Ya. [deceased]; FRANK-KAMENETSKIY, D.A.; VOYEVODSKIY, V.V., redaktor; SEMENOV, N.N., akademik, redaktor; ZALYSHKINA, O.V., tekhnicheskiy redaktor

[Oxidation of nitrogen during combustion] Okislenie azota pri gorenii. Moskva, Izd-vo Akademii nauk SSSR, 1947. 144 p.
(Nitrogen) (MLRA 9:3)

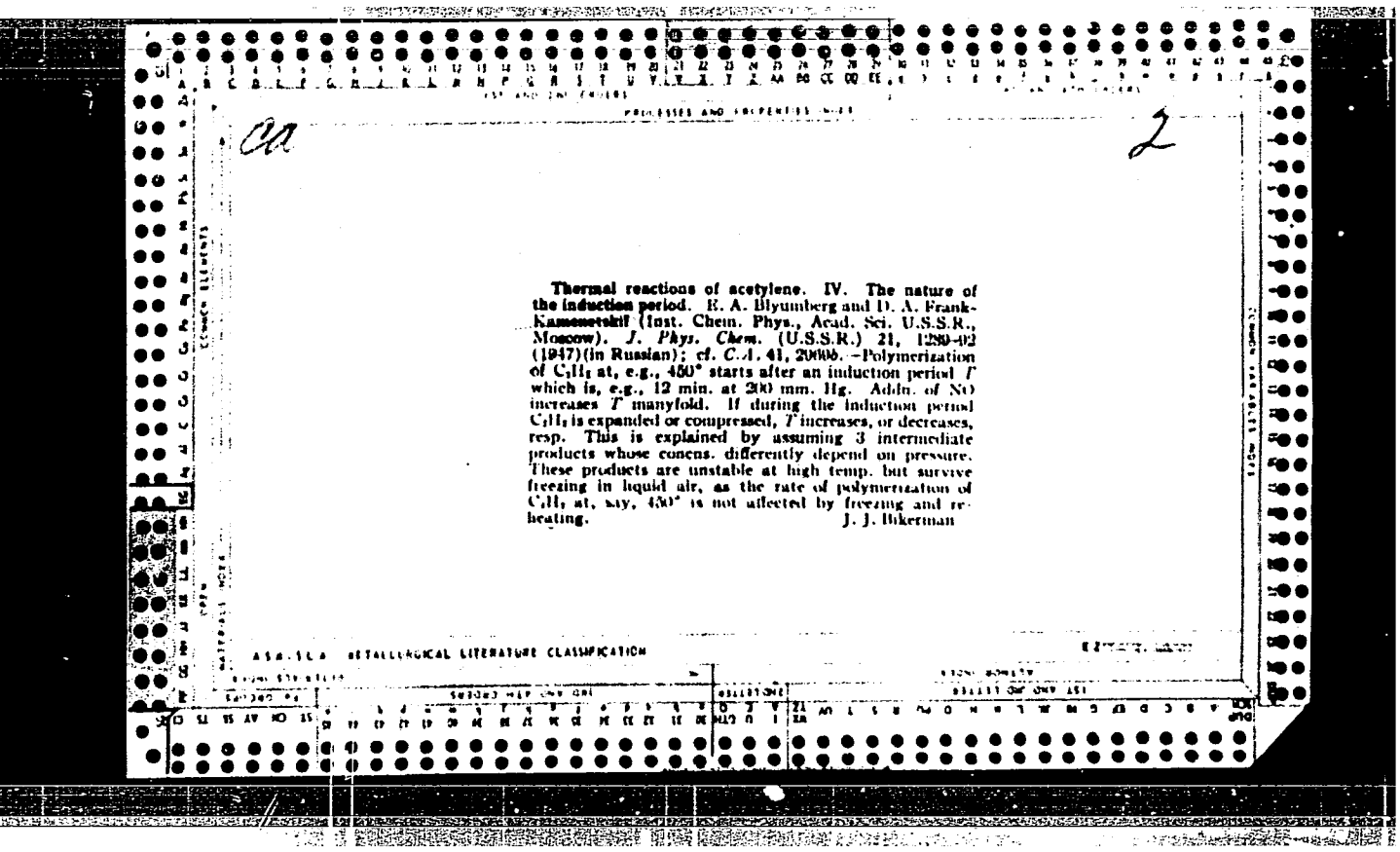


PROCESSES AND PROPERTIES INDEX

2

Refractometric method of rapid analysis of the condensate in the production of synthetic acetone. D. A. Frank-Kamenetskiĭ and E. B. Fridman (Gor'kiĭ State Univ.). *Zavodskaya Lab.* **13**, 43-7(1947)(in Russian).—Refractive indexes n_D^{20} of ternary mixts. Me_2CO-Me_2CHOH-H_2O were detd. and plotted against % H_2O for various Me_2CO-Me_2CHOH ratios. On all curves for Me_2CHOH 0-72% (of the sum Me_2CO + Me_2CHOH), n has a max. at about 24-15% H_2O; the max. disappears for pure Me_2CHOH-H_2O. At high H_2O contents, the curves for various Me_2CO/Me_2CHOH ratios become very close and tend to merge. Plots of d. similarly constructed against % H_2O show the Me_2CO and Me_2CHOH curves to be very close to each other up to 80% H_2O where they merge into one; consequently, analysis cannot be based on d. detns. alone but is feasible by simultaneous measurements of n and d. On the basis of the data, two nomograms were constructed permitting the reading of the Me_2CO and the Me_2CHOH contents from n and d., in ternary mixts. contg. not less than 30% Me_2CO. Measurements must be reduced to 15° which is done with the aid of auxiliary nomograms constructed on the basis of detns. of the temp. coeffs. In both artificial mixts. and in industrial condensates of catalytic oxidation of Me_2CHOH to Me_2CO, the method gave an accuracy of 2% with d. measured to 3, and n to 4, decimal digits. N., Thon

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



Thermal reactions of acetylene. IV. The nature of the induction period. B. A. Blyumberg and D. A. Frank-Kamenetskiĭ (Inst. Chem. Phys., Acad. Sci. U.S.S.R., Moscow). *J. Phys. Chem.* (U.S.S.R.) 21, 1289-92 (1947)(in Russian); cf. *C.A.* 41, 2000b.—Polymerization of C_2H_2 at, e.g., 450° starts after an induction period T which is, e.g., 12 min. at 200 mm. Hg. Addn. of NO increases T manyfold. If during the induction period C_2H_2 is expanded or compressed, T increases, or decreases, resp. This is explained by assuming 3 intermediate products whose concns. differently depend on pressure. These products are unstable at high temp. but survive freezing in liquid air, as the rate of polymerization of C_2H_2 at, say, 450° is not affected by freezing and re-heating.

J. J. Bikerman

FRANK-KAMENETZKIY, D.

USSR/Chemistry - Nitrogen Oxides Jan 1947
Chemistry - Combustion

"The Formation of Nitric Oxide During Combustion and Explosions: Part II, Influence of Vessel Size and Combustion Rate," D. Frank-Kamenetzkiy, Academy of Sciences of the USSR, 17 pp

"Acta Physicochimica URSS" Vol XXII, No 1

Experimental results are in accord with thermal theory, in regard to combustion with low hydrogen mixtures and in various sizes of vessels (i.e., yield rises with lower combustible content and decreases with higher, with increasing vessel sizes.) Study is made of the influence of water vapor. BS

26T4

FRANK-KAMENETSKIY, D. A.

USSR/Engineering
Machinery -- Construction
Gas Analyzers

Jan 1948

"A Catalytic Gas Analyzer for Ammonium-Air Mixtures," L. G. Urusovskaya, D. A. Frank-Kamenetskiy, Chernorechensk Chem Words imeni M. I. Kalinin, 4 pp

"Zavod Labor" Vol. XIV, No 1

Describes tests conducted to determine data necessary for construction of an apparatus permitteng uninterrupted control of ammonium-air mixture in process of oxidizing ammonia. Catalytic gas-analyzer used as basis of apparatus.

PA 61T33

Chernorechensk Chem. Factory imeni Kalinin

FRANK-KAMENETSKIY, D. A.

"Review of D. A. Frank-Kemenetskiy's Book 'Diffusion and Heat Transmission in Chemical Kinetics' Uspekhi Khimii, Vol 17, No 2, 1948

FRANK-KAMENETSKIY, D. A.

PA 11/49T97

USSR/Physics — Jul 48
Stellar Perturbations
Mathematics, Applied

"Oscillation Processes With Large Periods in Stars," D. A. Frank-Kamenetskiy, Inst Chem Phys, Acad Sci USSR, 3¼ pp

"Dok Ak Nauk SSSR" Vol LXI, No 2

Author previously considered it necessary to assume formation of heavy nuclei (or some such hypothetical process) to explain these stellar processes. Now considers this unnecessary, and that simple theory suggested by Critchfield and Bethe (Phys Rev, 1938)

[redacted]

11/49T97

USSR/Physics (Contd) — Jul 48

explains all known facts. Explains reasons, based on mathematical calculations. Submitted 24 Mar 48.

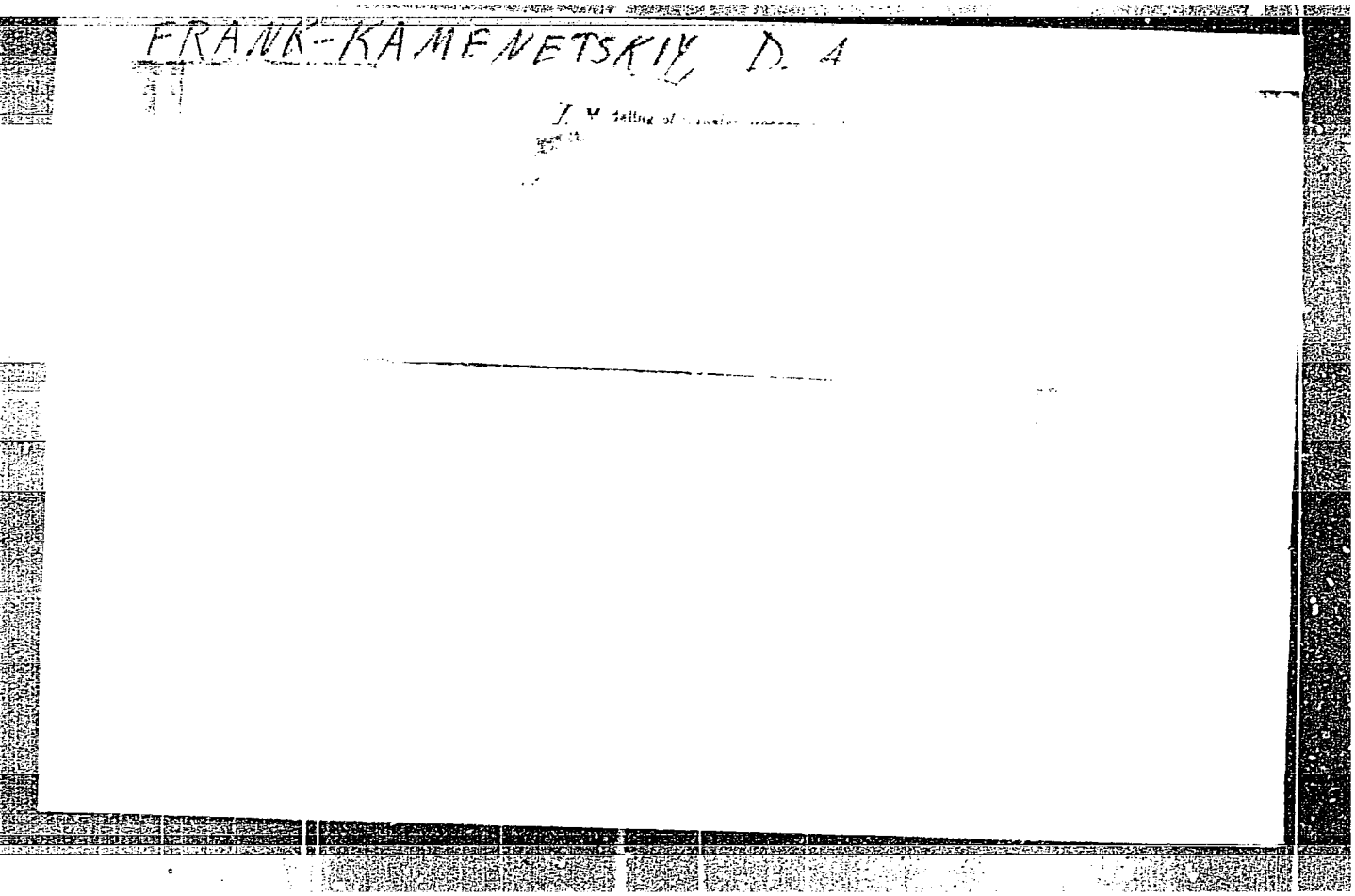
[redacted]

11/49T97

FRANK-KAMENETSKIY, D. A.

37231. Mechenyeaatomy. V Sb: nauka i zhizn'. M., 1949, s. 439-50.

SO: Letopis' Zhurnal'nykh Statey, Vol. 7, 1949



FRANK-KAMENETSKIY, D. M.

USSR/Academy of Sciences
Chemical Sciences May 49

"Annotations on Work Submitted in Competition for the D. I. Mendeleyev Award" 10½ pp

"Dok Ak Nauk SSSR" Vol LXVI, No 1

Among 16 works submitted for 1949 award are: V. I. Kuznetsov's "Internal Dissociation, Color and Chemical Activity of Intracomplex and Chelate Salts," V. K; Kozlov's "Theory of the Polarization of Real Molecules," and D. M. Frank-Kamenetskiy's "Diffusion and Heat Transmission in Chemical Kinetics."

PA 50/49T1

FRANK-KAMENETSKIY, D. A

Frank-Kamenetskii, D. A. Oscillatory stability and the auto-oscillations of stars.

[illegible] Mathematical Reviews Vol 12 No 10

FRANK-KAMENETSKIY, D. A.

USSR/Astronomy - Stellar Pulsations 11 Sep 51

"Non-Adiabatic Pulsations in Stars," D. A. Frank-Kamenetskiy

"Dok Ak Nauk SSSR" Vol LXXX, No 2, pp 185-188

Sets up the system of 2 differential eqs describing the pulsation of a star in the general case. Considers the behavior of pulsations close to the star's surface where they cannot be considered adiabatic. Finds that the oscillations of displacement can be represented as the sum of 2 components shifted 90° in phase, with their amplitudes of displacement varying with distance from the star's surface in essentially different manners. Submitted by Acad N. N. Semenov 23 Jul 51.

221T49

FRANK-KAMENETSKIY, D. A.

USSR/Astronomy - Pulsating Stars 11 Oct 52

"Nonlinear Oscillations in Stars," D. A. Frank-Kamenetskiy

"Dok Ak Nauk SSSR" Vol 86, No 5, pp 897-899

From his previous works (cf "Dok Ak Nauk SSSR" 77,385 (1951); 80,185 (1951)) author concludes possibility of construction of model of pulsating star with amplitudes increasing toward center within a peripheral zone a few hundreths of radius wide. Described model reflects type of

relation between amplitude and period of pulsation and may be applied to various classes of variables. Submitted by Acad N. N. Semenov 28 Jun 52.

245T29

PA 245T29

1. FRANK*KAMENETSKIY, MALEYEV T.F.

2. USSR (600)

4. Transcarpathis-Hydrocarbons

7. Curtisite from Transcarpathia, Dokl. AN SSSR 88 no.1, 1953.

9. Monthly List of Russian Accessions, Library of Congress, April 1953, Uncl.

FRANK - KAMENETSKIY, D. A.

AID P - 426

Subject : USSR/Astronomy

Card 1/1 Pub. 8, 5/16

Author : Frank-Kamenetskiy, D. A.

Title : Absorption of Hydrogen and the Correlation of Mass-Brightness

Periodical : Astron. zhur., v. 31-4, 327-334, Jl-Ag 1954

Abstract : A general theoretical formula for correlation of mass-brightness in parameters L/M^3 and $M^{2.5}/\sqrt{r}$ is deduced. The low central temperature of hydrogen stars prevents the neglect of H absorption. A curve of brightness of a hydrogen star as function of its mass is constructed and passes close to points belonging to stars of main sequence (classes A-K). Points of helium stars are above the curve and points of heavier elements below it. 22 formulae, 2 tables, 11 references.

Institution : Institute of Chemical Physics, Acad. of Sci., USSR

Submitted : October 20, 1953

FRANK-KAMENETSKIY, D. A.

USSR/Astronomy

Card 1/1 Pub. 22 - 11/47

Authors : Frank-Kamenetskiy, D. A.

Title : Pulsations near the surfaces of stars

Periodical : Dok. AN SSSR 99/1, 41-43, Nov 1, 1954

Abstract : Approximate expressions of the non-adiabatic pulsation state, which may exist near surfaces of stars, are derived. Five references (1935-1952). (Three Russians)

Institution : Institute of Chemical Physics of the Acad. of Scs. of the USSR

Presented by : Academician G. A. Shayn, June 10, 1954

FRANK-KAMENETSKIY, D.A.

USSR/Astronomy - δ Cephei

Card 1/1 Pub. 22 - 9/40

Authors : Frank-Kamenetskiy, D. A.

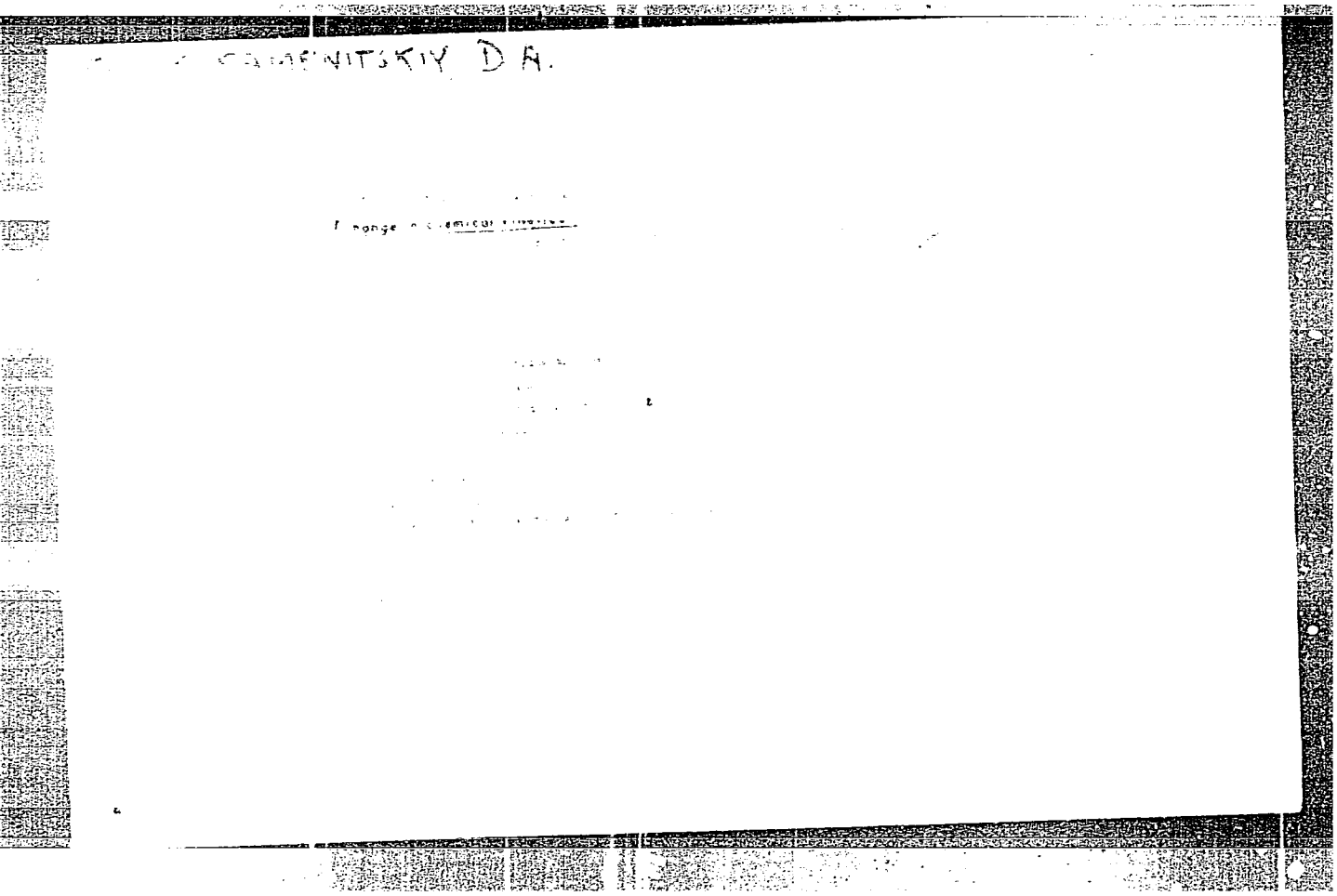
Title : An analysis of curves of radial velocities of the δ Cephei

Periodical : Dok. AN SSSR 99/2, 221-223, Nov 11, 1954

Abstract : A quantitative analysis of the curves representing radial velocity variations of the δ Cephei is given. The analysis is accomplished with the help of an approximated and simplified model of the above mentioned star. Seven references; 4-USSR (1937-1954). Diagram.

Institution : Institute of Chemical Physics of the Acad. of Scs. of the USSR

Presented by: Academician N. N. Semenov, May 21, 1954



Frank-Kamenetskii

[illegible] with generalized solutions for [illegible] and large flat vessels. Chapter 9 [illegible] Chapter [illegible] reactions. [illegible] are simultaneously necessary. The theory [illegible] tinction is covered, including the effect of thermal diffusion and net flow. Chapter 10 develops the necessary conditions for periodic or oscillatory processes, such as observed in the oxidation of hydrocarbons.

This volume is suitable as a [illegible]

C. F. Bonilla, USA

7/2

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413610003-3"

SOV/124-57-3-2731

Translation from: Referativnyy zhurnal. Mekhanika, 1957, Nr 3, p 15 (USSR)

AUTHOR: Frank-Kamenetskiy, D.A.

TITLE: The Central and Peripheral Theory of the Pulsations of the Cepheids (Tsentral'naya i perifericheskaya teoriya pul'satsiy tsefeid)

PERIODICAL: V sb.: Vopr. kosmogonii. Vol 4, Moscow, Izd-vo AN SSSR, 1955, pp 136-168

ABSTRACT: The fundamental premises of the peripheral and central theory of the pulsations of stars are examined. The theory of the central pulsations assumes that the adiabatic fluctuations occurring near the center of a star, where energy emission takes place, exhibit greater relative amplitudes than those in the peripheral zone. For the peripheral zone the theory assumes decaying entropy waves. The fundamental difficulties of the peripheral theory of pulsation are examined. The author employs the model of a star that is homogeneous in its central zone and then obtains a curve of radial velocities which coincides with the observed relationship for Delta Cephei, also the characteristic asymmetry of the radial velocities for typical cepheids at values of the relative amplitude which are much greater than those

Card 1/2

The Central and Peripheral Theory of the Pulsations of the Cepheids

actually observed. The latter is viewed by the author as a supplementary proof of the need for including a peripheral zone endowed with nonadiabatic oscillations into the investigation. Bibliography: 22 references.

M. I. Lidov

SOV/124-57-9-10003

Translation from: Referativnyy zhurnal, Mekhanika, 1957, Nr 9, p 17 (USSR)

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: The Problem of Self-excited Oscillations in the Theory of Variable Stars (Problema avtokolebaniy v teorii peremennykh zvezd)

PERIODICAL: V sb.: Pamyati Aleksandra Aleksandrovicha Andronova, Moscow, Izd-vo AN SSSR, 1955, pp 691-716

ABSTRACT: Continuation in a series of communications by the author on the subject (Dokl. AN SSSR, 1951, Vol 77, p 385; Vol 80, p 897; 1952 Vol 86, p 897. Under the assumption that for all elements of the mass of an oscillating star the conditions of oscillatory equilibrium coincide in time, i.e., assuming that there is no phase lag, the following expression is derived for the increment of the vibratory energy per cycle

$$\Delta W = \int_V dM \oint \left(1 - \frac{T_e}{T}\right) \frac{dE}{dt}\, dt \qquad (1)$$

where the first integration is performed with respect to the volume occupied by the mass of the star; the cyclic integral denotes

Card 1/4

The Problem of Self-excited Oscillations in the Theory of Variable Stars

integration with respect to time over one oscillatory period; T and T_e denote correspondingly the temperature of a given point at a given time and the temperature of the same point at the moment of its passage through the condition of equilibrium

$$\frac{dE}{dt} = \epsilon - \frac{dH}{dM}$$

where ϵ is the rate of energy liberation for a unit of mass, H is the heat flux over the spherical surface containing the mass M. The author assumes that

$$\epsilon = \epsilon_e \vartheta^p, \quad H = H_e \vartheta^q \quad (\vartheta = T/T_e)$$

Assuming that the exponents p and q which determine the dependence of ϵ and H on the temperature ϑ during the oscillatory cycle are constant throughout the volume of the star and are independent of the oscillatory amplitude and assuming that at every point of the star the conditions of mechanical and thermal equilibrium coincide, expression (1) will assume the following form

$$\Delta W = L_e \oint dt \left\{ \left[\vartheta_o^{p-1} (\vartheta_o - 1) - \vartheta_1^{q-1} (\vartheta_1 - 1) \right] - \frac{\vartheta_o^{q-1} - \vartheta_1^{q-1}}{q-1} \right\} \qquad (2)$$

Card 2/4

The Problem of Self-excited Oscillations in the Theory of Variable Stars

where L_e is the equilibrium value of the radiant flux of the star and the indices 0 and 1 refer to the center and the periphery of the star. The criterion of stability obtained from (2) by passing to infinitely small oscillations and determined by the sign of ΔW coincides with that of Cowling (cf. Cowling T.G., Monthly Notices Roy. Astron. Soc., 1934, Vol 94 p 768), if assumptions analogous to those made in the derivation of expression (2) are introduced into the latter. Assuming that

$$\vartheta = e^{A \sin \omega t} \tag{3}$$

and limiting $\vartheta - 1$ to the value of the first term

$$\vartheta - 1 \approx A \sin \omega t \tag{4}$$

the author reduces expression (2) to the following form

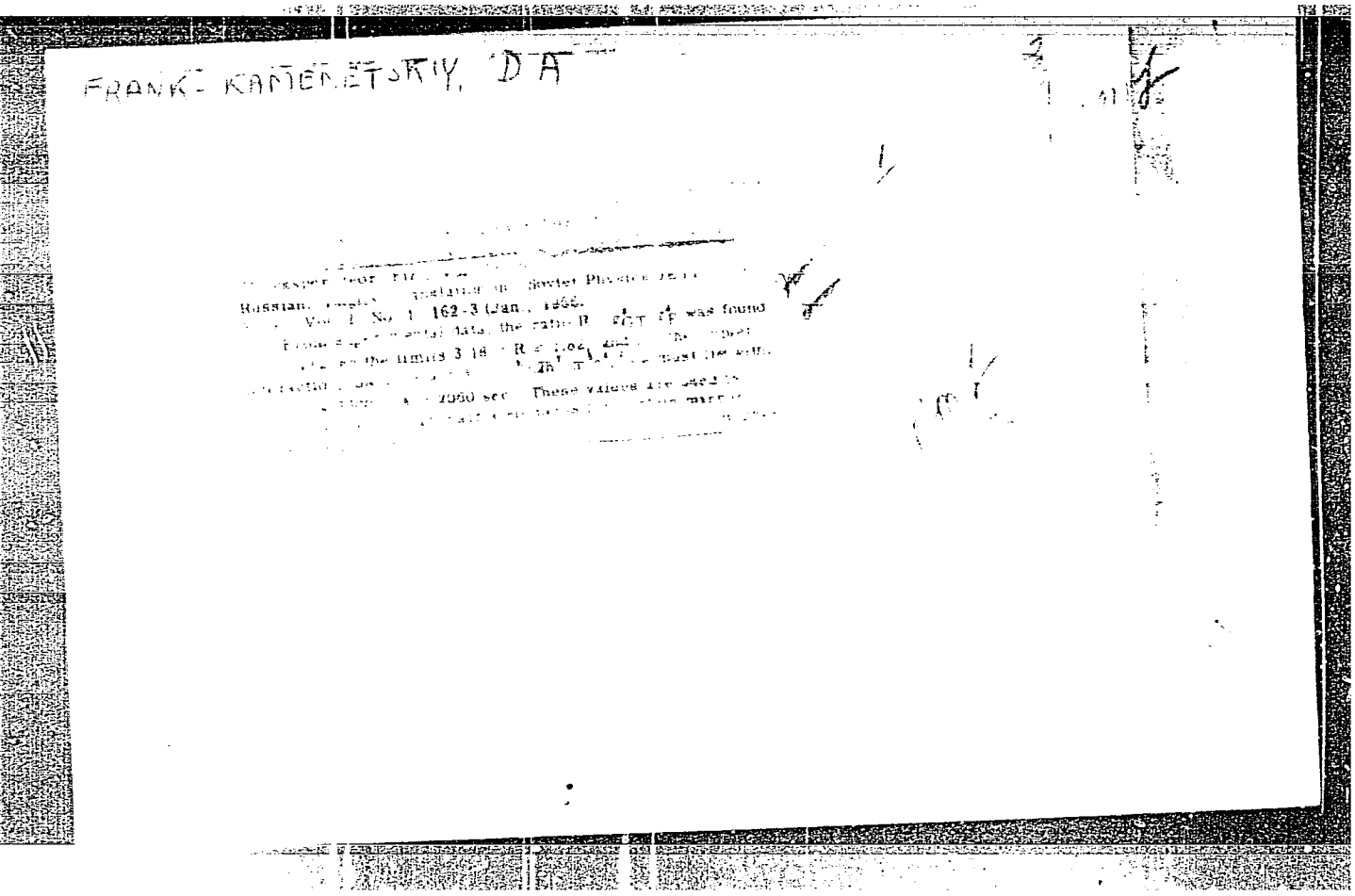
$$\Delta W = \frac{2\pi}{\omega} L_e \left\{ \left[A_o I_o'(p-1)A_o - A_1 I_o'((q-1)A_1) \right] - \frac{I_o(q-1)A_o - I_o(q-1)A_1}{q-1} \right\} \tag{5}$$

where I_o is the Bessel function of the imaginary argument and I_o' is its derivative. Expression (5) shows that the generation of self-excited oscillations is determined by the distribution of the oscillatory amplitudes along the radius of a star. The decrease in the relative oscillatory amplitudes from the center to the periphery of a star which according to the author is indispensable to the existence of self-excited oscillations does not conform to the well-known phenomenon of nonhomologous

The Problem of Self-excited Oscillations in the Theory of Variable Stars

adiabatic natural oscillations of stars which consists in an increase of the relative amplitude of the adiabatic natural oscillations from the center to the periphery. Nevertheless according to the author there is no contradiction here since even an arbitrarily small nonadiabatic condition of oscillation determines a distribution of the amplitudes along the radius of a star that is substantially at variance with the distribution that is characteristic of adiabatic oscillations. As the result of the author's deductions that the relative amplitude of nonadiabatic oscillations of a star decreases from the center to the periphery the carbon-cycle conception as the source of star energy must be abandoned. With such source of energy no star could possibly be stable. According to the author the liberation of energy in the hydrogen cycle offers a qualitative possibility of explaining the existence of stable as well as unstable (variable) stars depending on their internal structure. Bibliography: 12 references.

S. A. Zhevakin



FRANK-KAMENETSKIY, D. A.

2

The hydrogen-helium model of the sun. D. A. Frank-Kamenetskii. *Astron. Zhur.* 32, 139–49(1955).—F.-K. has calcd. a model of the sun based solely on reactions of H and He; the influence of heavy atoms can be treated as a perturbation. According to this model, the center of the sun has a temp. of 1.241×10^7°K., and contains 18.1% He. The introduction of heavy atoms can only increase the central temp. and the concn. of He. The principal characteristics of the model are insensitive to changes in chem. compn.; the H–He model can therefore be considered a good approximation to the truth. Cyrus Feldman

FRANK-KAMENETSKIY, D. A.

2

Solar models featuring energy production by means of the hydrogen cycle. D. A. Frank-Kamenetskii. *Astron. Zhur.* 32, 326–37(1955).—Models of N. A. Kozyrev, I. Epstein and L. Motz, A. Reiz, P. Natr, and F.-K. are discussed. The structure of a model (especially the d. contn. toward the center) depends on the relation between the opacity laws for the inner and outer regions. The principal characteristics of a model (the central temp. and the rate of energy production) are only slightly dependent on chem. compn. The sun's central temp. is 12.3–14.2 × 10^6 °K. By assuming energy production by the H cycle only, β-decay consts. of 370–4400/sec. were calcd. for the various models. Cyrus Feldman

FRANK-KAMENETSKIY, D.A.

Hydrogen curves on the phase diagrams of stars. Dokl.AN SSSR 104 no.1:30-33 S '55. (MLRA 9:2)

1.Institut khimicheskoy fiziki Akademii nauk SSSR. Predstavlena akademikom N.N.Semenovym.
(Stars--Spectra) (Hydrogen--Spectra)

FRANK-KAMENETSKIY, D. A.

Vol - emf

Numerical value of the constants of triplet β-decay.
D. A. Frank-Kamenetskiĭ. *Soviet Phys., JETP* 2, 162 (1956).
(Translation). See C.A. 49, 15506f.
H. M. P.

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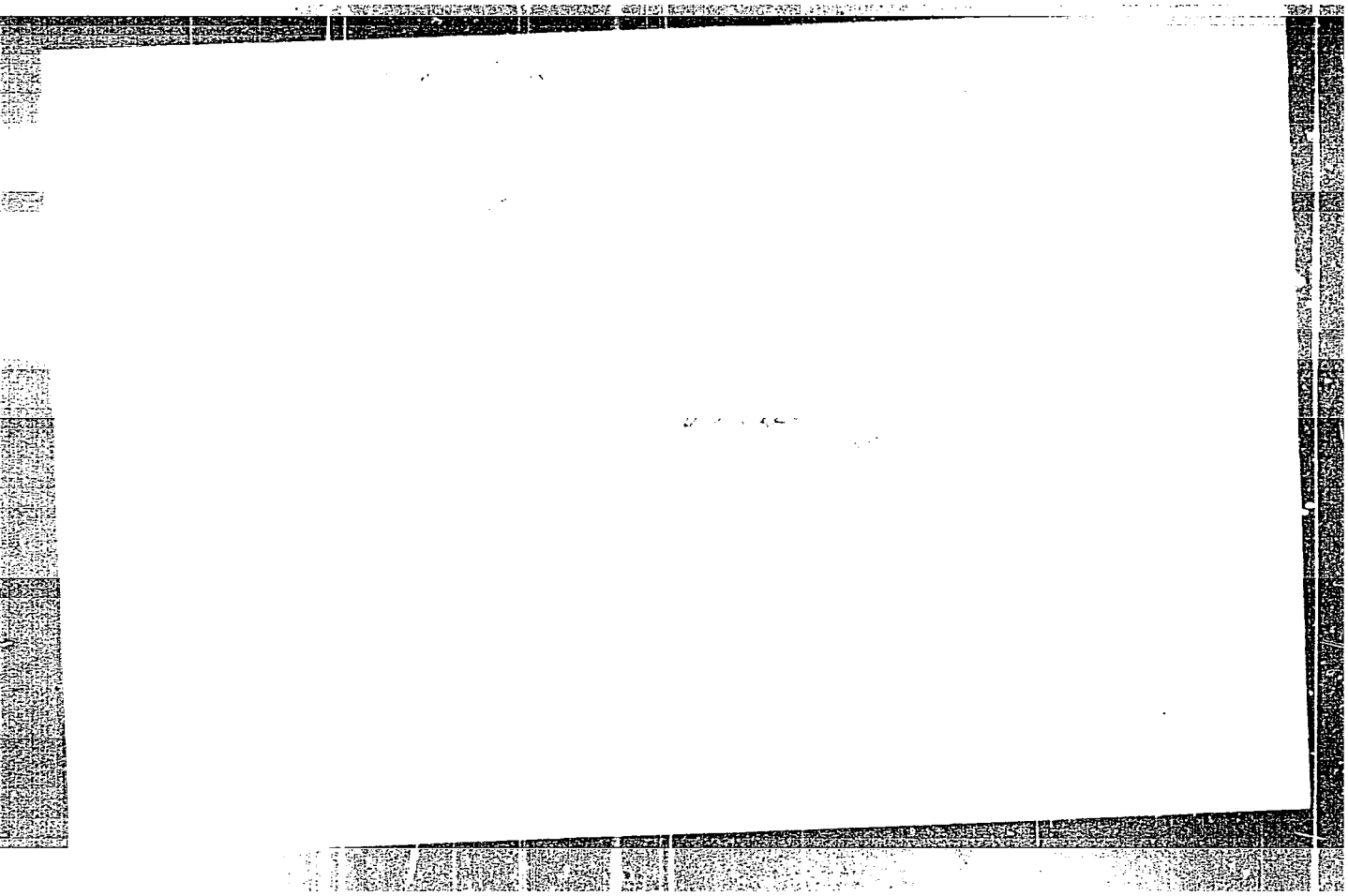

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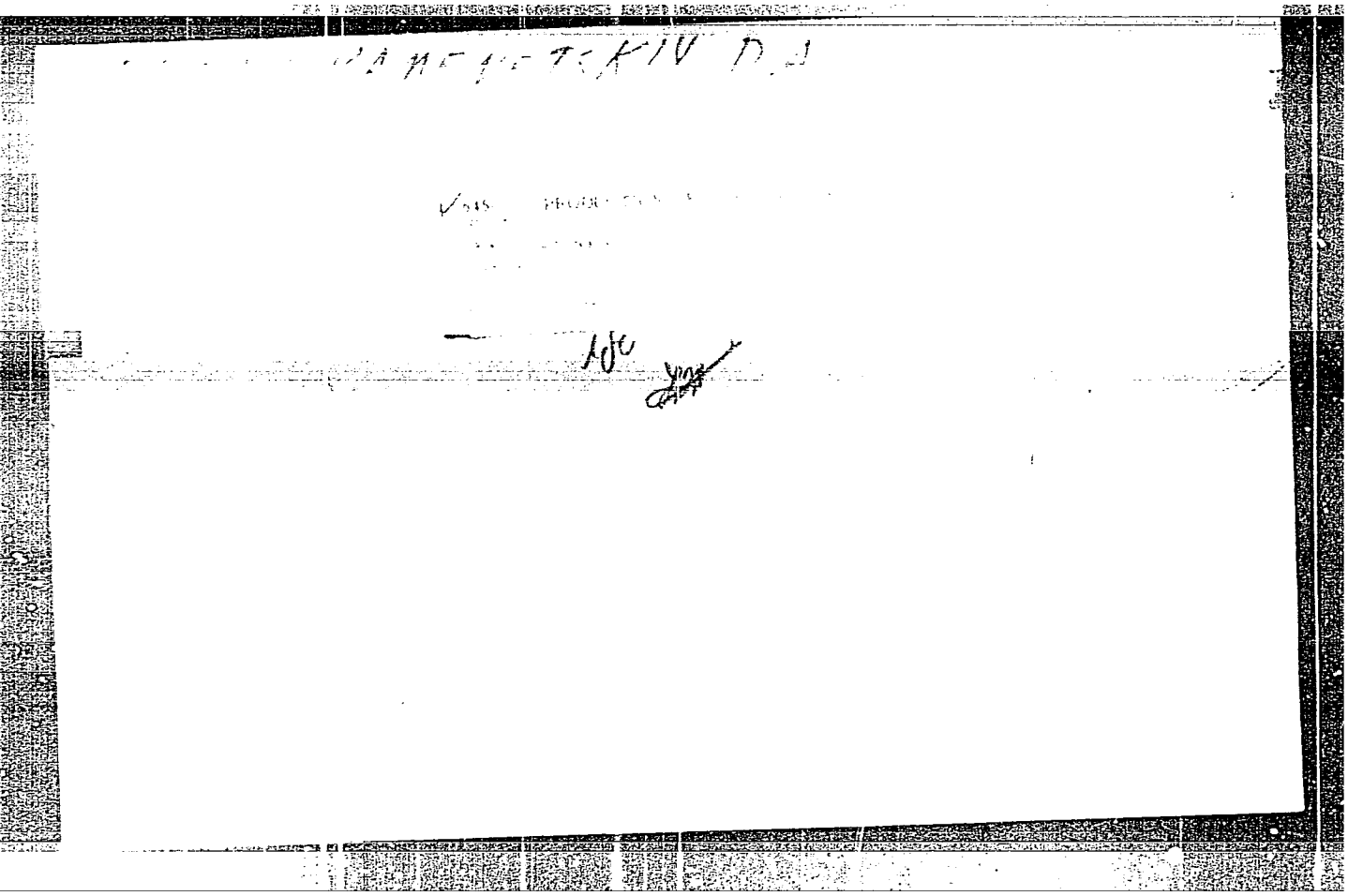
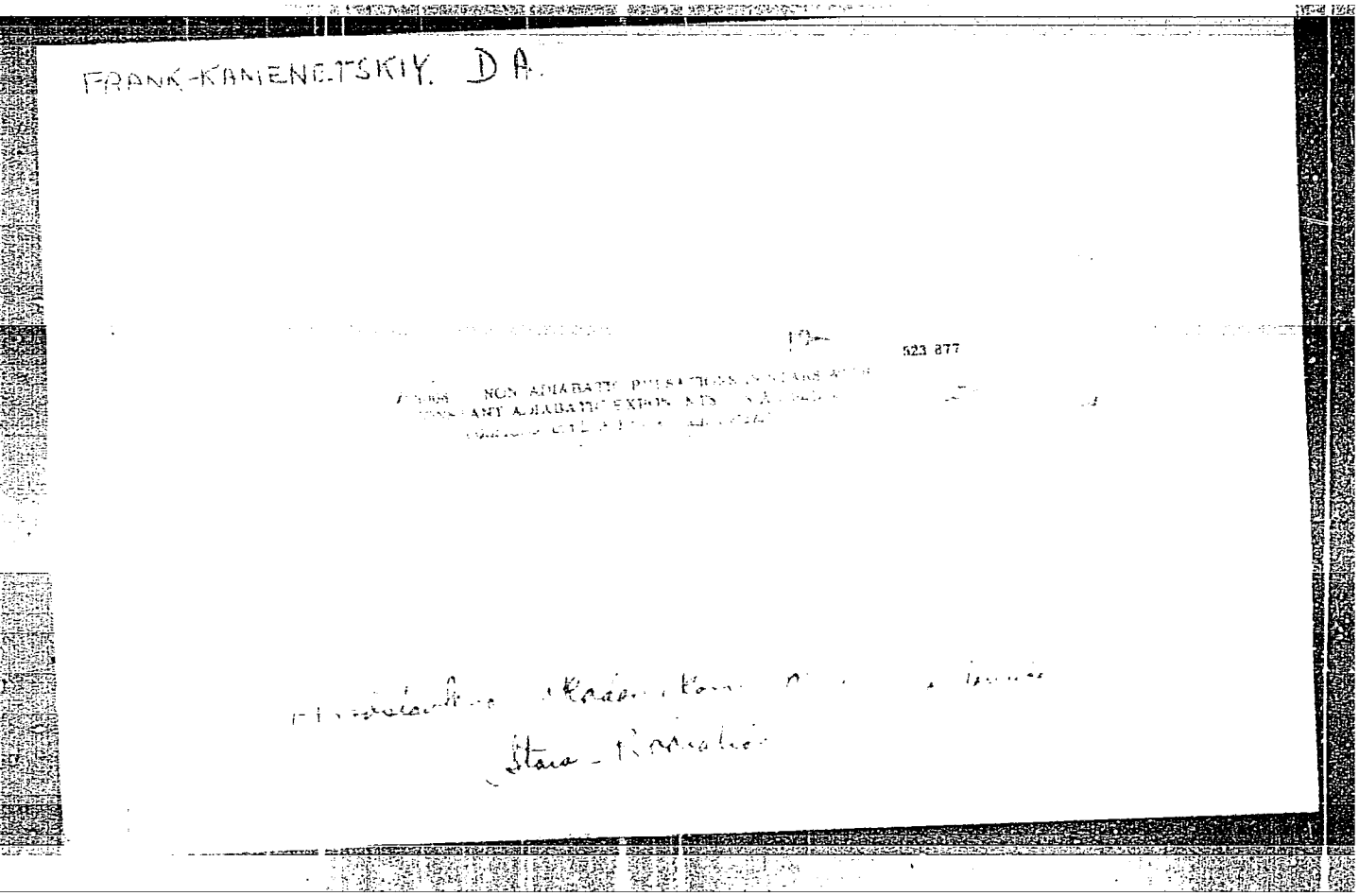




FRANK-KAMENETSKIY. D A.

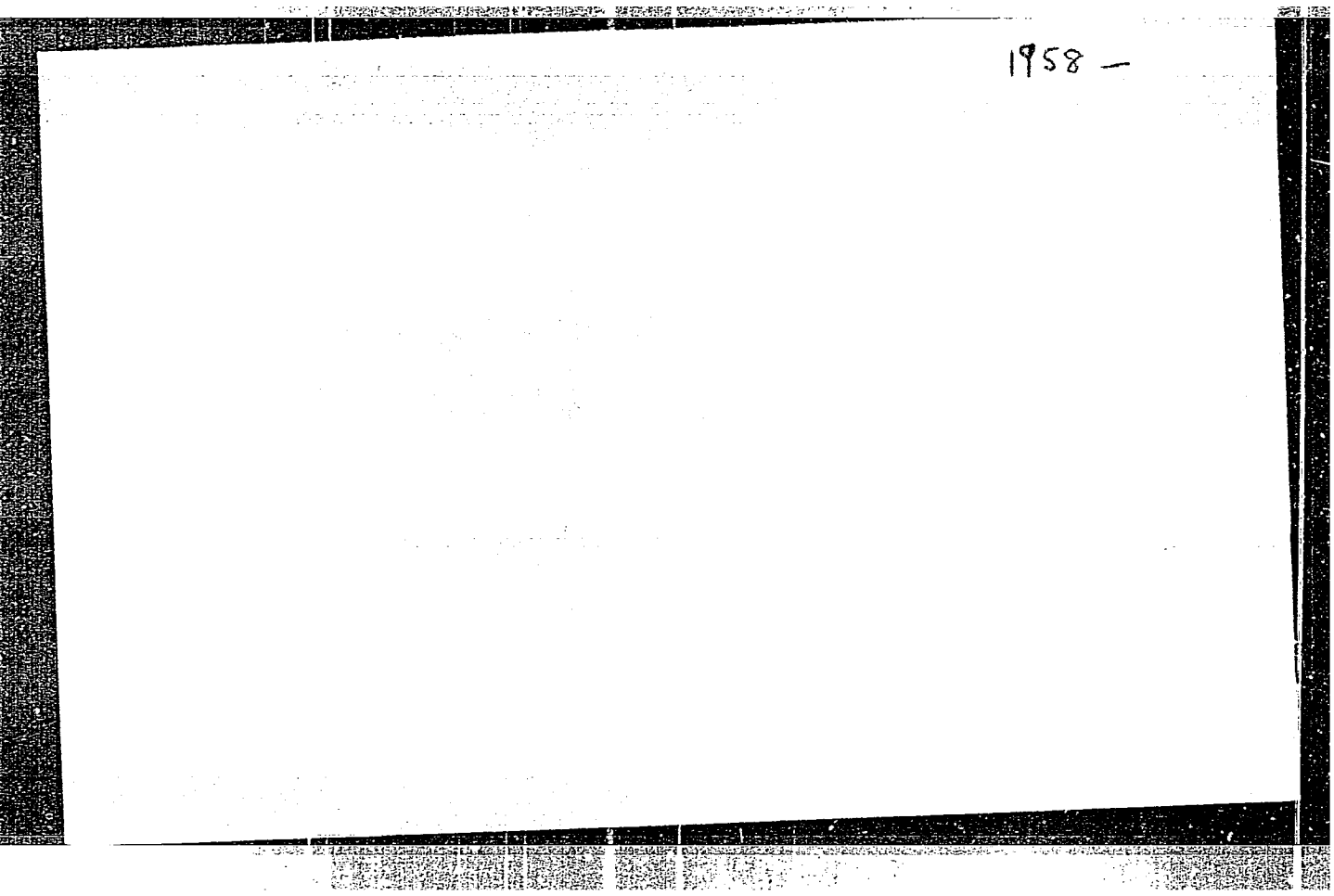
523 877

Frank-Kamenetskii, D. A. On the spatial amplitude distribution in a pulsating star. Voprosy Kosmog. 5 (1957), 123–148. (Russian. English summary)

The non-adiabatic oscillation equations are investigated for "quasi-adiabatic" solutions, i.e., entropy wave amplitude small compared to displacement amplitude. The entropy wave amplitudes are found to grow without bound as the center is approached. The situation is more involved for the displacement amplitudes. It appears that there are circumstances in which these amplitudes decrease as the center is approached.

R. G. Langebartel (Urbana, Ill.).

2



FRANK-KAMENETSKIY, D.A., prof.

Conquering thermo nuclear energy. IUn. tekh. 3 no.11:7-9 N '58. (MIRA 11:12)

(Nuclear reactions)

AUTHOR: Frank-Kamenetskiy, D. A. 76-32-5-44/47

TITLE: An Analytical Solution of the Thermal Explosion Problem in the Case of a Cylinder (Analiticheskoye resheniye zadachi o teplovom vzryve dlya tsilindricheskogo sluchaya)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol. 32, Nr 5, pp.1182-1183 (USSR)

ABSTRACT: In an earlier work it was shown that the critical conditions of the thermal inflammation can be brought to the conditions of the equation

$$\Delta^2\theta = \delta e^{\theta}$$

For the cylindrical and spherical case the critical values for δ were found by means of a numerical integration, the number 2 being obtained as a result; there remains the question if this was an accident, or if really a whole-number solution results. Tonnemann and Cowight (Ref 2) by accident obtained a substitution which makes it possible to deduce the cylindrical case to the plane one, in which case an equation is obtained for both cases; just as well are obtained the

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An Analytical Solution of the Thermal Explosion Problem in the Case of a Cylinder

corresponding deductions for each limit condition as well as a transcedent equation from which $\delta_{kr} = 2$ is obtained. It is found that in spite of directly integrating the equation for the plane case according to standard methods the critical conditions in the cylindrical case are of simpler character, the characteristics of the solution being carried out in an essential way by determination of the characteristics on the axis. There are 2 references, 1 of which is Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut, Moskva
(Moscow, Institute of Physics and Technology)

SUBMITTED: September 26, 1957

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1. Thermodynamics--Mathematical analysis
2. Cylinders--Thermodynamic properties

AUTHOR: Frank-Kamenetskiy, D.A., Professor (Moscow) SOV-26-58-8-7/51

TITLE: Powerful Electric Pulse Charges in Gases (Moshchnyye impul'snyye elektricheskiye razryady v gazakh)

PERIODICAL: Priroda, 1958, Nr 8, pp 41-44 (USSR)

ABSTRACT: The Lenin Prize has been awarded to L.A. Artsimovich and his coworkers for powerful electric pulse charges in gases. At temperatures of several thousands of degress thermal ionization starts, the gas atoms lose their electrons and are transformed into plasma in which collisions between charged particles are very improbable. The effective cross section of the collision between charged particles in plasma is inversely proportional to the square of the temperature. In order to use electric current for heating plasma, the interaction of electric current and a magnetic field is employed. In the conductor in which current flows, a ponderomotor force is acting which is perpendicular to the direction of the current as well as to the magnetic field. The currents in two parallel conductors incite a magnetic field which causes the conductors to approach each other. This force of attraction is $H^2/8\pi$ where H is the tension of the magnetic field. It is the total of the ponderomotor forces of interaction of each of the currents with

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the magnetic fields incited by the other currents. The magnetic field compresses the plasma. The temperature of the compressed gas is increased. It is possible to heat a gas to very high temperatures by this method, because electric resistance plays no role in this procedure. The plasma, however, is not stable. Once a particle has escaped from the center of the magnetic force it cannot return, because "magnetic pressure" has decreased. In order to increase the temperature of the plasma it is necessary to increase the stability by applying another magnetic field around the first one, or to carry out the compression so fast that there is no time for the plasma to become instable. During the fast compression of the plasma a magnetohydrodynamic shock wave forms moving to the cylinder axis, being repelled by it, moving to the periphery, and there being refracted by a "magnetic buffer". Several compressions following one after another are obtained by this method. During the compressions, the plasma emits an X-ray and a neutron radiation which are not due to a nuclear fusion, but to an electromagnetic acceleration. The observation of the spectra during compression indicated the degree of ionization and of the temperature. The described

FRANK-KAMENETSKIY, David Al'bertovich; BENYUMOV, O.M., red.; ATROSHCHENKO, L.Ye., tekhn.red.

[Obrazovanie khimicheskikh elementov v nedrakh zvezd. Moskva, Izd-vo "Znanie," 1959. 30 p. (Vsesoiuznoe obshchestvo po rasprostraneniiu politicheskikh i nauchnykh znanii. Ser.9. Fizika i khimiia, no.10) (MIRA 12:5)
(Stars) (Nuclear reactions) (Chemical elements)

FRANK-KAMENETSKIY D. A.

SOV/3609

PHASE I BOOK EXPLOITATION

Soveshchaniye po voprosam kosmogonii, 6th, 1957.

Trudy soveshchaniya...; vnegalakticheskaya astronomiya i kosmologiya (Transactions of the 6th Conference on Problems of Cosmogony; Extragalactic Astronomy and Cosmology) Moscow, Izd-vo AN SSSR, 1959. 273 p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Astronomicheskiy Sovet.

Editorial Board: D.A. Frank-Kamenetskiy, Professor (Resp. Ed.); B.A. Vorontsov-Vel'yaminov, Corresponding Member, Academy of [illegible] Sciences USSR; Ya. A. Smorodinskiy, Professor; A.L. Zel'manov, Senior Scientific Contributor; and [illegible] (Scientific Secretary) Junior Scientific Contributor; Ed. of Publishing House: L.V. Samsonenko; Tech. Ed.: G.N. Shevchenko.

PURPOSE: The publication is intended for astronomers, geophysicists and theoretical physicists interested in general problems of cosmology.

COVERAGE: This is a collection of reports given at the 6th Conference on the Problems of Cosmogony, June 5-7, 1957. In the publication observational data in the field of extragalactic astronomy are summarized, the data are analyzed from a theoretical point of view, and the accuracy and reliability of the observations are evaluated. The relativistic cosmological theories are discussed in detail for the first time in Soviet literature and correlated with observational data, primarily with the red-shift measurements. The relationship of cosmology to the theory of the formation of chemical elements and general thermodynamic and philosophical problems of cosmology are also investigated. No personalities are mentioned. References accompany some of the articles.

MORNING SESSION OF JUNE 6.

COSMOLOGICAL THEORIES BASED ON THE GRAVITATION THEORY

EVENING SESSION OF JUNE 6.

RADIO ASTRONOMY AND COSMOLOGY. ORIGIN OF CHEMICAL ELEMENTS

MORNING SESSION OF JUNE 7.

GENERAL PROBLEMS OF COSMOLOGY

1/4

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413610003-3"

FRANK-KAMENETSKIY, D.A.

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PHASE I BOOK EXPLOITATION SOV/3762

Konferentsiya po magnitnoy gidrodinamike. Riga, 1958.

Voprosy magnitnoy gidrodinamiki i dinamiki plazmy; trudy Konferentsii. (Problems in Magnetohydrodynamics and Plasma Dynamics; Transactions of a Conference) Riga, Izd-vo AN Latviyskoy SSR, 1959. 343 p.
Errata slip inserted. 1,000 copies printed.

Sponsoring Agency: Akademiya nauk Latviyskoy SSR. Institut fiziki.

Editorial Board: D.A. Frank-Kamenetskiy, Doctor of Physics and Mathematics, Professor; A.I. Vol'dek, Doctor of Technical Sciences, Professor; I.M. Kirko, Doctor of Physics and Mathematics; V.Ya. Veldre, Candidate of Physics and Mathematics; V.G. Vitol, Candidate of Physics and Mathematics; Yu.M. Krumin'; and V.Ya. Kravchenko.

Ed.: A. Teytel'baum; Tech. Ed.: A. Klyavinya

PURPOSE: This book is intended for physicists working in the field of magnetohydrodynamics and plasma dynamics.

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Problems in Magnetohydrodynamics (Cont.) SOV/3762

COVERAGE: This volume contains the transactions of a conference held in Riga, June 1958, on problems in applied and theoretical magnetohydrodynamics. The objects of the conference were the investigation of the basic trends in theoretical and applied magnetohydrodynamics, establishing contact between the people doing research in different branches of magnetohydrodynamics, and promoting the participation of theoretical physicists in problems in applied magnetohydrodynamics. More than 160 persons from different parts of the Soviet Union took part in the conference, and 55 papers were read. Similar conferences are to be held regularly in the future; the next such conference is scheduled to be held in Riga in June 1960. In this present collection of the transactions of the conference, most of the papers and comments on papers are presented by the authors themselves in an abridged form. The book is divided into two parts: the first part deals with problems in theoretical magnetohydrodynamics and plasma dynamics, and consists of 35 articles on such aspects of the problem as the application of magnetohydrodynamics in astrophysics (D.A. Frank-Kamenetskiy), magnetohydrodynamics and the investigation of cosmic-ray variations (L.I. Dorman), acceleration of plasma in a magnetic field (G.V. Gordeyev and A.I. Gubanov), stability of shock waves and magnetohydrodynamics (A.I. Akhiyezer). The second part, consisting of 33 articles, deals with problems of experimental magnetohydrodynamics, including the application of physical simulation for investigation of electromagnetic processes in liquid metals (I.M. Kirko) and the development of electromagnetic pumps (P.G. Kirillov), at the Institute of Physics of the

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Academy of Sciences, Latvian SSR. Several articles are devoted to induction pumps, electromagnetic crucibles, electromagnetic stirrers for molten metals, and their application in the metallurgical industry including schematic diagrams of their power-supply systems. References are given at the end of most of the articles.

TABLE OF CONTENTS:

Frank-Kamenetskiy, D.A.

PHASE I BOOK EXPLOITATION SOV/3651

Vsesoyuznoye astronomo-geodezicheskoye obshchestvo

Astronomicheskiy kalendar' 1960 (Astronomical Calendar, 1960) Moscow, Fizmatgiz, 1959. 351 p. (Series: Its: Yezhegodnik; peremennaya chast', vyp. 63) 7,200 copies printed.

Ed.: I.Ye. Rakhlin; Tech. Ed.: S.N. Akhlamov; Editorial Board: P.I. Bakulin (Resp. Ed.), M.M. Dagayev, S.G. Kulagin, A.G. Masevich, P.P. Parenago.

PURPOSE: The book is intended for astronomers and geophysicists and physicists interested in astronomical phenomena.

COVERAGE: This yearbook on astronomy was compiled by a number of Soviet scientists specializing in several different branches of astronomy. The following persons participated in the work: L.D. Kovbasyuk, who wrote the chapters on ephemerides of the Sun and Moon; M.M. Dagayev, the chapters on planets, eclipses, physical coordinates of the Sun, Moon, Mars, and Jupiter, and the satellites of Jupiter and Saturn; V.S. Lazarevskiy, the chapters on ephemerides and heliocentric longitudes of planets; Ye.G. Demidov, the chapters on occultation of stars and planets by the Moon, observations of Polaris and computation of coordinates of stars; V.A. Bronshten, the chapters on comets; N.S. Yakhontova, sections on minor planets; and N.B. Perova, the chapters on variable stars. The appendixes contain articles on recent developments and events in astronomy such as the launching of the first Soviet space rocket, the 10th Congress of the International Astronomical Association, held in Moscow in August 1958, developments in astronomy in 1958 during the IGY. There are 385 references, all Soviet.

AVAILABLE: Library of Congress

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PHASE I BOOK EXPLOITATION SOV/3932

Frank-Kamenetskiy, David Al'bertovich

Fizicheskiye protsessy vnutri zvezd (Intrastellar Physical Processes) Moscow, Fizmatgiz, 1959. 543 p. 3,000 copies printed.

Ed.: L.V. Bamsonenko; Tech. Ed.: Ye.A. Yermakova.

PURPOSE: This book is intended for astrophysicists and astronomers.

COVERAGE: The book attempts to show the applications of modern atomic and nuclear physics to astrophysics, to give the bases of methods of calculating physical processes proceeding at temperatures in the order of millions of degrees, and to show the interrelations between physics and astrophysics. The author limits himself to non-relativistic theory, thus considerably simplifying the explanation of the interaction of radiation with matter. The book is divided into four parts. Part I reviews the observed data, and discusses elementary theory, and homogeneous and heterogeneous star models. Part II is concerned strictly with physics and contains basic theoretical material. In Part III, the physics previously discussed is viewed in the light of the known astrophysical facts.

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3(1) SOV/26-59-12-12/45

AUTHOR: Frank-Kamenetskiy, D.A., Professor (Moscow)

TITLE: The Physics of Stars and Nebulae. The Plenary Session of the Commission of the Astronomical Council of the Academy of Sciences of the USSR

PERIODICAL: Priroda, 1959, Nr 12, pp 60-62

ABSTRACT: The article summarizes papers read at a meeting in L'vov of astronomers from Moscow, Leningrad, Yerevan, the Krymskaya astrofizicheskaya observatoriya (Crimean Astrophysical Observatory), Alma-Ata, L'vov, Abastumani and Kiyev. The first meeting dealt with the non-thermal radiation of stars, which has been studied intensively by the school of V.A. Ambartsumyan in Yerevan and at the Byurakanskaya observatoriya (Byurakan observatory). V.A. Ambartsumyan surveyed the nature of the blue galaxies. L.V. Mirzoyan and M.A. Arakelyan discussed the continuous radiation of non-stationary red dwarf stars, such as T I Taurus and pulsating stars.

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The Physics of Stars and Nebulae. The Plenary Session of the Commission of the Astronomical Council of the Academy of Sciences of the USSR

M.A. Arakelyan and N.L. Ivanova discovered that a continuous spectrum extends far beyond the limits of the Balmer series. V.A. Dombrovskiy (Leningrad) read a report on the polarization of star radiation. At the beginning of the second meeting, two reports were heard on the theory of radiative transfer propounded by V.A. Ambartsumyan and V.V. Sobolev. S.A. Kaplan (L'vov) offered a solution of the problem of the scattering of light in a medium with a moving boundary. I.N. Minin (Leningrad) gave a complete solution to the question of the diffusion of radiation in a semi-infinite medium. V.V. Porfir'yev (L'vov) describes the results of his many years of work on the internal structure of revolving stars. At the same meeting, two astronomers from Alma-Ata, I.D. Kupo and Yu. V. Glagolevskiy, read papers on the results of the detailed spectrophotometric study

The Physics of Stars and Nebulae. The Plenary Session of the Commission of the Astronomical Council of the Academy of Sciences of the USSR.

of several stellar spectra. The third meeting was devoted to the linear spectra of stars. A.A. Nikitin (Leningrad) surveyed the possible influence of certain minor physical effects on ionization calculations. A.A. Boyarchuk (Crimea) reported on the chemical composition of B-stars. I.M. Kopylov (Crimea) described methods and results of determining electronic density in the atmospheres of hot stars. R.N. Kumaygorodskaya (Crimea) gave the results from observations of Of-Type stars. The fourth meeting heard reports on stars connected with nebulae. I.S. Shklovskiy analyzed some remarkable data, received from rockets, on strong ultra-violet radiation in areas surrounding hot stars. G.A. Gurzadyan explained the improbably high temperatures ascribed to the nuclei of planetary nebulae as

The Physics of Stars and Nebulae. The Plenary Session of the Commission of the Astronomical Council of the Academy of Sciences of the USSR.

being caused by the synchrotronic radiation of relativistic electrons. D.A. Rozhkovskiy (Alma-Ata) calculated the dynamics of a collision between a dark dust cloud and a hot star. M.V. Dolidze (Abastumani) described observations on groups of emission stars and their connection with diffusion nebulae. E.V. Turchaninova (Kiyev) gave the results of a detailed photometric study on the distribution of matter in certain planetary nebulae.

5 (0), 3 (1)

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: The Forming of Chemical Elements (Proiskhozhdeniye khimicheskikh elementov)

SOV/53-68-3-9/11

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 68, Nr 3, pp 529-556 (USSR)

ABSTRACT: The theory of the formation of chemical elements described by the author is based upon the empirical data concerning the chemical composition of cosmic matter and the distribution of chemical elements in cosmic space, such as are available in modern science. It is explained on the basis of a semi-logarithmic diagram by Suess and Urey (Fig 1). The special position occupied by helium and hydrogen is discussed in detail (thus, the number of hydrogen atoms is to that of silicon atoms in the ratio 40000 : 1). In the following, this distribution curve is discussed in detail and its most important qualitative rules are given. The author then discusses the possible ways of synthetizing the elements from the point of view of nuclear physics. All possible ways are mentioned: 1) Reactions between charged particles (thermonuclear reactions, reactions in the case of cold acceleration). 2) Reactions under participation of neutrons. First, the physical conditions for

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the development of thermonuclear reactions are briefly given and some of their particular features are discussed. In the following, the physical conditions in the interior of stars (as e.g. the sun) are discussed and the theory of hydrostatic equilibrium is explained in short. In the next chapter the author discusses the theory of the pre-stellar formation of elements. This theory is divided into two parts: the theory of the thermodynamic equilibrium and the theory of the capture of primary neutrons. The Soviet scientist G. I. Pokrovskiy occupied himself with investigating, among others, also this problem. The theory of neutron capture and its verification is dealt with in especially great detail. In the next chapters of this paper the heterogeneous stars (problems of classification, of surface temperature, of brightness, of our galactic system (Fig 2), - the galactic theory by B. V. Kukarkin - the galaxy consists of a spherical and a flat disk-shaped component - composition and properties of these components - theory by P. P. Parenago; stars with inhomogeneous internal structure (shells) are called heterogeneous) and the helium reactions are discussed in detail. The next chapter deals with slow and fast processes of neutron capture (Figs 5, 6), and the following one with the nucleus

with the maximum neutron excess (according to P. E. Nemirovskiy: Z = 56). Furthermore, the author discusses the thermonuclear theory of the formation of elements, the scandium as a cosmo-chemical thermometer, the iron maximum, the so-called circumvented nuclei (oboydennyye yadra) - rare elements, dotted curve in figure 1, as well as, finally, the forming of elements in cold acceleration processes and the (p,n)- and (p, 2n)-reactions. The author succeeded in showing that the forming of all chemical elements from hydrogen is possible by means of processes which still today occur in known stars. There are 7 figures, 1 table, and 35 references, 10 of which are Soviet.

21(7)
AUTHOR: Frank-Kamenetskiy, D. A.

SOV/53-68-4-10/12

TITLE: Bibliography (Bibliografiya)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 68, Nr 4, p 737 (USSR)

ABSTRACT: The author gives a review of the book "Prevrashcheniya atomnykh yader" (Transformations of Atomic Nuclei) by Gol'danskiy, V. and Leykin, Ye. (Price 12 Rubles) published in 1958 by the publishing house of the AS USSR, Moscow.

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21(0) SOV/53-69-1-11/11

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: Bibliography (Bibliografiya)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 69, Nr 1, pp 169-170 (USSR)

ABSTRACT: At the Publishing House for Foreign Literature at Moscow, the translation of a book by Bethe and Morrison was published in 1958. It is entitled "Elementarnaya teoriya yadra" (Elementary Theory of the Nucleus) and was translated from the English original text by O. A. Vladimirova (under the editorship of V. B. Berestetskiy). The book is reviewed.

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FRANK-KAMENETSKIY, D.A.

[Magnetoacoustic resonance in a plasma] Magnitno-zvukovoi rezonans v plazme. Moskva, In-t atomnoi energii, 1960. 14 p. (MIRA 17:1)

RUSANOV, V.D.; PATRUSHEV, B.I.; KOVAN, I.A.; GARKUSHA , V.I.; FRANK-KAMENETSKIY, D.A.

[Use of double electric probes in studying magneto-acoustic resonance in a plasma] Issledovanie magnitno-zvukovogo rezonansa v plazme s pomoshch'iu dvoinykh elektricheskikh zondov. Moskva, In-t atomnoi energii AN SSSR, 1960. 18 p. (MIRA 17:1)

AKIMATOV, A.P.; BLINOV, P.I.; BOLOTIN, V.F.; BORODIN, A.V.; GAVRIN, P.P.; ZAVOYSKIY, Ye.K.; KOVAN, I.A.; OGANOV, M.N.; PATRUSHEV, B.I.; PISKAREV, Ye.V.; RUSANOV, V.D.; SKOLKIN, G.Ye.; STRIGANOV, A.R.; FRANK-KAMENETSKIY, D.A.; CHEREMNYKH, P.A.; CHIKIN, R.V.

[Magnetoacoustic resonance in a plasma] Magnito-zvukovoi rezonans v plazme. Moskva, In-t atomnoi energii, 1960. 23 p. (MIRA 17:2)

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D001/D006

AUTHOR: Frank-Kamenetskiy, D.A., Professor (Moscow)

TITLE: Below Absolute Zero

PERIODICAL: Priroda, 1960, Nr 3, pp 17-22 (USSR)

ABSTRACT: This article deals with the concept of negative temperatures. After a general introduction, the author outlines the different temperature concepts found in thermodynamic, statistical, classical and quantum physics. Discussing negative temperature in statistical physics, he takes the example of a hydrogen atom and tabulates its energy levels (Figure 1). He then shows how conditions of negative temperature can be obtained by shuffling particles of varying energy so that their number is greater in the upper energy levels than the lower. This reversal of the relationship between energy and number creates the state of negative temperature

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Below Absolute Zero

(Figure 2). Reconciling this with the thermodynamic temperature concept, the author explains how the same condition may be created if the number of energy levels is restricted and an equal distribution of particles at all levels is achieved. More energy is then imparted to the upper level and negative temperature arises. Since the transition from positive to negative temperature occurs through infinity, it may be deemed that temperatures below absolute zero are higher than infinity (Figure 3) - a fact which is borne out by the thermodynamic behavior of bodies at a negative temperature in that they give off surplus energy even when out of contact with bodies capable of absorbing it. The dependancy of the duration of condi-

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Below Absolute Zero

tions of negative temperature on the speed of inter-particle energy exchange is discussed and the author notes that the state of inequilibrium necessary to negative temperature becomes one of equilibrium and positive temperature when there is no external source of energy. These factors have led to new methods of generating and amplifying electromagnetic waves, based on the transit of atoms or molecules from the higher to the lower energy level and their consequent quantum emissions. Lenin prize-winners N.G. Basov and A.M. Pokhorov [Ref 1] used these phenomena to develop the first molecular generators and amplifiers. After a discussion of spin temperature (Figures 4 and 5), the author describes how negative temperature can be obtained. The article concludes with a summary of the present and prospective use of

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D001/D006

Below Absolute Zero

temperatures below absolute zero, e.g. for amplification, etc. There are 4 diagrams, 1 table, 1 graph and 1 Soviet reference.

Card 4/4

S/026/60/000/06/01/006

AUTHOR: Frank-Kamenetskiy, D.A., Professor

TITLE: A New Victory in the Conquest of Space. The Spaceship and Science

PERIODICAL: Priroda, 1960, No. 6, pp. 3 - 4

TEXT: This is an announcement of the launching of the spaceship on May 15, 1960. The total weight of the ship without the last stage of the rocket was 4,540 kg. A special detachable airtight capsule weighing 2.5 tons, contained a load representing the weight of a man and the necessary requisites for his flight. Data obtained show the accuracy of calculations the Soviet scientists made when constructing the spaceship. The launching of the spaceship is the beginning of the new science of cosmic electrodynamics. It has been found recently that after an eruption on the sun the rotational speed of the earth changes. It will also be possible to make observations in the region of ultra-violet and X-rays outside the atmosphere of the earth. Nuclear astrophysics will receive data concerning the nuclear processes on distant stars at various stages of their development.

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AUTHOR: Frank-Kamenetskiy, D.A., Doctor of Physico-Mathematical Sciences

TITLE: Magnetic Fields in the Universe

PERIODICAL: Nauka i zhizn', 1960, No. 6, pp 27 - 31

TEXT: The magnetohydrodynamics, interstellar magnetic fields, radioastronomy the discrepancy between the theories and the actual data obtained on the behaviour of the magnetic fields are explained in generally comprehensive terms. Soviet scientists V.L.Ginzburg, S.B.Pikel'ner and I.S.Shklovskiy are mentioned having done great work in the studies on weak magnetic fields in the Universe, on the theory of the origin of cosmic rays and radioastronomy; I.S.Shklovskiy explained the continuous spectrum of the Crab nebula by synchrotronic radiation of relativistic electrons. Explanations are illustrated by schematic drawings. There are 7 figures.

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FRANK-KAMENETSKIY, David Al'bertovich, professor fiziki.

What is the origin of elements? Tekh.mol. 28 no.5:5-7 '60.
(MIRA 13:7)

(Chemical elements)

S/057/60/030/008/002/019
B019/B060

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: Magnetic Sound in a Three-component Plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol. 30, No. 8, pp. 893 - 898

TEXT: In the introduction, the author discusses the three forms of damping of plasma oscillations: (1) damping due to collisions; (2) anomalous or specific damping due to the Cherenkov or the cyclotron absorption (for electrostatic oscillations the Landau damping constitutes a specific case), and (3) damping due to turbulence. In the present paper, the author restricts himself to the case of damping due to collisions, and investigates the same in hydrodynamic approximation. It is shown in a brief discussion that when studying magneto-acoustic oscillations in the plasma by considering collisions it is most suitable to take account of the part played by neutral particles as well. The author therefore studies a plasma consisting of electrons, ions, and neutral particles, and derives the approximate formula (7) for the

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magneto-acoustic phase propagation rate by neglecting the gas pressure. He further obtains relation (15) which describes spatial damping. Formula (16) describes the concentration of neutral particles, and formula (17) determines the transition from the skin effect to spatial damping at low frequencies in the magneto-acoustic range. There are 2 Soviet references.

VC

SUBMITTED: April 9, 1960

S/057/60/030/008/003/019
B019/B060

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: Magneto-acoustic Resonance in the Plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol. 30, No. 8, pp. 899 - 906

TEXT: The first section of the present paper deals with the high-frequency heating of a plasma. The transmission of energy from the generator to the plasma presupposes a good coupling between them. Oriented resonance oscillations are thereby produced in the plasma, which the author designates as resonant rises. Since, however, the energy of all particles moving about in one phase is not usable for nuclear reactions, resonance effects must be used for the disorientation of particle motion which differ in their nature from the resonant rises. These resonance effects are called here absorption resonances. Working with absorption resonances, however, is incompatible with the above-mentioned condition of a good coupling between generator and plasma. Only the magneto-acoustic resonance has been known as a resonant rise to this day, and the author

investigates it in great detail. In the second section, the author studies the magnetic sound and offers formulas (4) and (5) for the magneto-acoustic propagation rate, with gas pressure being neglected in formula (4). The limits of applicability of these formulas are thoroughly studied, and the number of collisions is especially considered. In the third section, the author derives expression (16) for the resonance frequency by neglecting the gas pressure, wherein the energy transfer from the high-frequency circuit to the plasma is greatest. The fourth section deals with the study of anomalous dispersion and absorption, and finally the limit amplitude and nonlinearity are discussed. Amplitudes in the plasma interior are shown to grow to infinity in a linear hydrodynamic approximation, and it is further shown that amplitudes are practically bounded by nonlinearity. The possibility is finally indicated of heating a plasma to high temperatures with the aid of a magneto-acoustic energy transfer and subsequent absorption of this energy by phase resonance.

VB

AKHMATOV, A.P.; BLINOV, P.I.; BOLOTIN, V.F.; BORODIN, A.V.; GAVRIN, P.P.; ZAVOYSKIY, Ye.K.; KOVAN, I.A.; OGANOV, M.N.; PATRUSHEV, B.I.; PISKAREV, Ye.V.; RUSANOV, V.D.; SMOLKIN, G.Ye.; STRIGANOV, A.R.; FRANK-KAMENETSKIY, D.A.; CHEREMNYKH, P.A.; CHIKIN, R.V.

Magnetoacoustic resonance in a plasma. Zhur. eksp. i teor. fiz. 39 no.3:536-544 S '60. (MIRA 13:10)
(Nuclear magnetic resonance)
(Plasma (Ionized gases))

83766

S/056/60/039/003/019/045
B004/B060

26.1410

AUTHOR: Frank-Kamenetskiy, D. A.

TITLE: Eigenoscillations of a Bounded Plasma

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3 (9), pp. 669-679

TEXT: The author studied the oscillations of a cold plasma column surrounded by conductive walls and situated in a homogeneous, static and longitudinal magnetic field. Equations of motion are written down for the charged plasma particles and for the current density, and equations for simple cylindrical waves are obtained. Boundary conditions are defined for the eigenoscillations of the bounded plasma. The frequencies below the ion cyclotron frequency are designated as the magnetoacoustic frequency range. This can be realized at a high linear density of electrons (according to S. E. Braginskiy). The dispersion equation (25) is represented in dimensionless coordinates (53). Approximate equations are obtained for low-frequency oscillations of a long cylinder. The

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Eigenoscillations of a Bounded Plasma

author further studied the excitation of oscillations in the plasma and the magnetoacoustic resonance. The following results were obtained: The resonance at eigenfrequencies is characteristic of bounded plasma. These eigenfrequencies are dependent upon the concentration of the plasma and upon boundary conditions (thus, also on the geometrical form). The resonance at eigenfrequencies gives rise to the penetration of alternating fields into the plasma (excitation resonance). If, however, the eigenfrequency of the plasma fits the single-particle resonance, it is not possible to set the plasma oscillating (absorption resonance). Also the ion and electron cyclotron resonances belong to the latter. They merely give rise to heating of the plasma surface, because the plasma is impermeable to these frequencies. The resonances of anomalous dispersion near that frequency at which the refractive index becomes infinite, possess frequencies approaching the eigenfrequencies of the unbounded plasma. The author thanks V. P. Demidov for his discussions. There are 12 references: 7 Soviet, 3 US, 1 German, and 1 Swedish.

SUBMITTED: April 2, 1960

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88419

S/056/60/039/006/003/063
B006/B056

26.2311

AUTHORS: Rusanov, V. D., Patrushev, B. I., Kovan, I. A., Garkusha, V. I., Frank-Kamenetskiy, D. A.

TITLE: Investigation of the Magneto-acoustic Resonance in a Plasma by Means of Two Electrical Probes

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 6 (12), pp. 1497 - 1502

TEXT: This is a report on concentration measurements made on a cylindrical hydrogen plasma, which was located in a homogeneous quasistatic longitudinal magnetic field H_0, and a high-frequency magnetic field in the same direction. Two molybdenum wire probes were used to estimate the charged particle concentration; probing was done also with the 3-cm pulses of a klystron-generator. The experimental arrangement is shown in Fig. 1, the probe circuit diagram in Fig. 3. Fig. 5 is shown as an example of the oscillograms obtained (Figs. 4-9): the upper oscillograms show the probe currents of various pairs of probes, the lower ones show the signals of

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the sound shf generator; I - probes on the walls, II - in the chamber axis. (U_{probe} = 300 v, E = 6kv, H_0 = 5.8 koe, p = 8.10^{-4} mm Hg). The probe current has two maxima, viz. at H_0 = 650 oe (n = $6.10^{12}cm^{-3}$) and H_0 = 1580 oe (n = $5.10^{12}cm^{-3}$) (n - electron concentration). With a change of the quasistatic magnetic field, the amplitude of the alternating field was found to have two or three resonance maxima, interpreted as magneto-acoustic resonance. The resonance frequencies are near the geometrical mean from electronic and ionic cyclotron frequency (ω_e, ω_i). Numerically one obtains:

	1st maximum	2nd maximum
$\omega^* = H_0 u_1 \sqrt{4\pi\varrho}\, R$	$6.0.10^7$	$3.1.10^8$
$\omega = \dfrac{\omega_i \omega_e \left[1 + \frac{1}{\Pi^2}\frac{\omega_e}{\omega_i}\frac{k_z^2}{k_r^2}\right]\left[\Pi^2 + 1 + \frac{\omega_e^2}{\omega_0^2}\right]}{\sqrt{\omega_i\omega_e}}$	$7.3.10^7$	4.10^8
	$2.5.10^7$	$6.5.10^8$

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(The generator frequency was $3.2.10^8$). ω^* is the circular frequency of the radial magneto-acoustic oscillations, ω-the circular frequency of the longitudinal-radial magnetoacoustic oscillations; the other quantities are defined in Ref. 5. Summing up: Under magneto-acoustic resonance, ionization increases rapidly and considerably. The radial concentration distribution in the plasma is nearly uniform. The authors thank Ye. K. Zavoyskiy for his interest. There are 10 figures and 5 references: 4 Soviet and 1 US.

SUBMITTED: April 23, 1960

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88420
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B006/B056

9.9845
26.2321

AUTHORS: Patrushev, B. I., Rusanov, V. D., Kovan, I. A., Savichev, V. Ya., Frank-Kamenetskiy, D. A.

TITLE: Gyrotropic Properties of a Plasma During the Propagation of an Extraordinary Wave

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 6 (12), pp. 1503 - 1507

TEXT: This is a report on investigations of the propagation of electromagnetic waves in a cylindrical plasma column, which is located in a homogeneous quasistatic magnetic field H_0. The hydrogen plasma ($8 \cdot 10^{-4}$ mm Hg) was generated by means of an ionization generator (50 Mc/sec, 150 kw) in a glass cylinder. The high-frequency magnetic field coincided with the static field as to direction. A detailed description of the experimental arrangement is given in Ref. 1. The plane-polarized waves were produced by a sounding generator with 29 Mc/sec and 500 w, whose operation was not disturbed by discharges. The block diagram for investigating the signal from the magnetic probe, located in the anodic circuit of the sounding

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Gyrotropic Properties of a Plasma During the Propagation of an Extraordinary Wave

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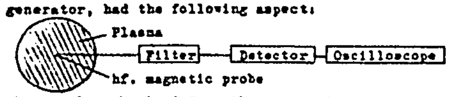
generator, had the following aspect:



The results obtained from these experiments are shown in a number of oscillograms and are numerically given in a Table. It could be proven that in the propagation of a wave whose frequency is between the ion- and electron cyclotron frequencies, both the wave vector and the polarization vector rotate in the plasma waveguide. This result is of interest for the retaining and hf-heating of plasma. The authors thank Ye. K. Zavoyskiy for his interest and L. I. Rudakov for discussions. There are 10 figures, 1 table, and 6 Soviet references.

SUBMITTED: April 23, 1960

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FRANK-KAMENETSKIY, D.A., professor (Moskva)

Testing the theory of relativity. Priroda 49 no.8:86 Ag '60. (MIRA 13:8)

(Relativity (Physics))

FRANK-KAMENETSKIY, D.A., prof. (Moskva)

Wave theory and its applications ("Water waves" by J.J.Stoker. Reviewed by D.A.Frank-Kamenetskii). Priroda 49 no.8:118-119 Ag '60. (MIRA 13:8)

(Waves) (Stoker, J.J.)

FRANK-KAMENETSKIY, D.A.

Review of F.A.Baum, K.P.Staniukovich, and B.I.Shekhter's book "Explosion physics." Usp. fiz. nauk 72 no.4:841-842 D'60. (MIRA 13:11)
(Explosions) (Baum,F.A.) (Staniukovich,K.P.) (Shekhter,B.I.)

FRANK-KAMENETSKIY, D.A.

"Theory of nuclear reactors on thermal neutrons." A.D.Galanin. Reviewed by D.A.Frank-Kamenetskii. Usp. fiz. nauk 77 no.3: 653-654 N '60. (MIRA 16:8)

(Nuclear reactions)
(Galanin, A.D.)

BK

PHASE I BOOK EXPLOITATION SOV/5877

Frank-Kamenetskiy, David Al'bertovich

Plazma - chetvertoye sostoyaniye veshchestva (Plasma, the Fourth State of Matter) Moscow, Gosatomizdat, 1961. 131 p. Errata slip inserted. 12,000 copies printed.

Ed.: A. F. Alyab'yev; Tech. Ed.: N. A. Vlasova.

PURPOSE: This book is intended for engineers, scientific workers non-specialists and students interested in problems of controlled thermonuclear reactions and plasma acceleration.

COVERAGE: The book contains the basic ideas of plasma physics as developed by considering the plasma as the model of a continuous conducting medium (magnetic hydrodynamics), and as developed by studying the motion and collisions of individual charged particles (physical kinetics). Plasma oscillations, instability, compression and confinement by magnetic fields, and acceleration are analyzed with regard to application. Formulas are given for simple cases only. The author thanks S. I. Braginskiy,

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A. A. Vedenov, E. P. Velikhov, V. P. Demidov, E. K. Zavoyskiy, B. B. Kadomtsev, I. A. Kovan, V. I. Kogan, M. A. Leontovich, B. I. Patrushev, L. I. Rudakov, V. D. Rusanov, R. Z. Sagdeyev, and V. D. Shafranov for their advice, and T. D. Kuznetsova for the illustrations. There are no references.

TABLE OF CONTENTS:

S/026/61/000/001/002/007
A166/A027

AUTHOR: Frank-Kamenetsky, D.A., Professor

TITLE: The Physics of Space and Time

PERIODICAL: Priroda, 1961, No. 1, pp. 17-24

TEXT: The article explains some current conceptions of the physics of space and time and the relation between the geometric and the quantum theories in this respect. There are 7 daigrams and 3 Soviet references.

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FRANK-KAMENETSKIY, D., prof.

Substance and antisubstance. IUn. tekh. 5 no. 2:8-10 F '61. (MIRA 14:5)

(Particles (Nuclear physics))

FRANK-KAMENETSKIY, D.A., doktor fiziko-matematicheskikh nauk, prof.

Remarks of a physicist. Nauka i zhizn' 28 no.7:88-90 Jl '61.
(MAGNETISM--PHYSIOLOGICAL EFFECT)

FRANK-KAMENETSKIY, D.A., doktor fiziko-matematicheskikh nauk

"Three destinies" by Anna Livanova. Reviewed by D.A. Frank-Kamenetskii. Nauka i zhizn' 28 no.8:45 Ag '61. (MIRA 14:8)
(Geometry, Non-Euclidean)
(Livanova, Anna)

22770
S/057/61/031/005/001/020
B104/B205

21.2311

AUTHORS: Zavoyskiy, Ye. K., Kovan, I. A., Petrushev, B. I., Rusanov, V. D., and Frank-Kamenetskiy, D. A.

TITLE: Magnetosonic method of plasma ionization

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 5, 1961, 513-517

TEXT: The conventional methods of producing concentrated plasma are discussed in the introduction. It is noted that the application of these methods to a magnetic field is limited. The thermal method can only be used for atoms of low ionization potentials. Ionization by longitudinal current causes instabilities, and ionization by an oscillating electron beam meets with experimental and technical difficulties. The concentration of plasma attainable by h-f discharge is limited by the plasma frequency, and the production of concentrated plasma by a longitudinal alternating field requires the use of millimeter and sub-millimeter waves. The authors tested several methods of obtaining concentrated plasma, which are not limited by the plasma frequency. This is achieved by an alternating electric field, the electric vector of which is perpendicular to a

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Magnetosonic method...

static magnetic field. This method makes it possible to use electron and ion-cyclotron or magnetosonic resonances. The latter method is not limited as to the attainable plasma concentration. It makes use of magnetosonic oscillations of a limited plasma volume, and from the theory of these oscillations it follows that the velocity amplitude of the azimuthal electron drift is given by $v_e = \omega V/\omega_i$ (1), where V denotes the velocity amplitude of the radial plasma motion. For the kinetic electron energy one has

$$E=\frac{mv_e^2}{2}=\frac{1}{2}\frac{\omega^2}{\omega_i\omega_e}\frac{H_1^2}{4\pi n_e}. \qquad (3)$$

where H_0 indicates the strength of the static magnetic field, H_1 the amplitude of the alternating magnetic field, and ω its frequency; ω_e and ω_i are the electron and ion cyclotron frequencies, respectively, and n_e denotes the electron concentrations. Ionization by radial magnetic sound is possible if its energy is higher than the ionization energy. It is obvious that the required amplitude of the alternating field is the higher, the higher are the concentration and strength of the static field. With a

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Magnetosonic method...

given amplitude of the h-f field $\tilde{H}$ and a given plasma concentration, there exists a threshold H^* of the static field strength above which ionization will not be possible any longer. By increasing the amplitude of the h-f field, the strength of the static field and the attainable plasma concentration can be extended infinitely. In a strong static field, however, a very strong alternating field is required for obtaining high concentrations by radial magnetic sound. Ionization by magnetic sound has been observed experimentally in a quasi-static field in several installations. Effective ionization occurred both below and above the hybrid frequency, resulting in concentrations of more than 10^{13} cm^{-3}. The ionization had the nature of resonance and was always accompanied by the penetration of an alternating field into the plasma. Fig. 1 shows resonance ionization by a h-f magnetic field with an increase of the quasi-static magnetic field in time. By blanking a 3-cm probe signal it was possible to indicate a concentration higher than 10^{12} cm^{-3}. The penetration of an external h-f field was observed by means of a magnetic probe introduced into the discharge space. In fields larger than H^*, concentration dropped considerably. It could be shown that in experiments

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Magnetosonic method...

with a quasi-static magnetic field, H^* is a linear function of H. This can be explained by formula (3). The calculated values of H^* are somewhat lower than the experimental ones, i.e., ionization can be achieved more easily than would have been expected from the drift. This can be ascribed to longitudinal currents which are due to the fact that the oscillations are not completely radial. Based on these results the authors designed the model of a plasma source with magnetosonic ionization. The plasma comes from the source which is placed in a magnetic field and flows along the field into a measuring volume. In previous experiments, a plasma column having a diameter of 6 cm and a concentration of 10^{12} cm^{-3} was obtained in the measuring volume at a rated power of the ionization generator of 4 kw. The experiments were made above the hybrid frequency, in weak magnetic fields where the drift motion imparts energy to the electrons, which is sufficiently high for ionization. There are 4 figures and 8 references: 7 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: P. C. Thonemann et al., Nature, 181, 217 1958.

SUBMITTED: July 21, 1960

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89325

S/033/61/038/001/008/019
E032/E314

24.6510

AUTHOR: Frank-Kamenetskiy, D.A.

TITLE: (p, n) and (p, 2n) Reactions and the Origin of Bypassed Nuclei

PERIODICAL: Astronomicheskiy zhurnal, 1961, Vol. 38, No. 1, pp. 91 - 98

TEXT: The astrophysical theory of the origin of elements (Burbridge et al - Ref. 1, Frank-Kamenetskiy - Ref. 2 and Lavrukhina - Ref. 3), according to which chemical elements are formed as a result of thermonuclear reactions during the outbursts of supernovae, has progressed considerably in recent years. An important problem of the theory is the explanation of the origin of bypassed nuclei, i.e. nuclei which have an excess of protons and do not lie in the path of neutron capture. For $Z \gtrsim 30$ the abundance of all the bypassed nuclei is lower than the abundance of the neighbouring nuclei, which do not lie in the path of neutron capture, by approximately two orders of magnitude. This is generally accepted as an argument in favour of the fact that the principal mechanism of

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(p, n) and (p, 2n) Reactions and the Origin of Bypassed Nuclei

nucleogenesis for $Z > 30$ is a sequence of neutron-capture and β-decay processes. However, if the bypassed nuclei play only a secondary role in nature then an analysis of the possible ways in which they can be formed will produce particularly valuable information for the theory of the origin of elements. The neutron capture process is not very dependent on the physical conditions. Bypassed nuclei, on the other hand, should be produced in more energetic processes which can only occur under more sharply defined conditions. In order to approach objectively the problem of the origin of bypassed nuclei, the present author considers all the possible nuclear processes which can lead to their formation from the parent nuclei which lie in the path of neutron capture. These processes are shown schematically in Fig. 1. The dotted line shows the path of neutron capture. The nuclei

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